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POPULAR MECHANICS MAGAZINE

WRITTEN SO YOU CAN UNDERSTAND IT

SEE PAGE 960

Pick Your Job—I'll Train You!

Eight Weeks in Either of my Schools and You step into the Big Pay Class

This Will Start You On The Road to Independence

Get out of the rut of underpaid, no advancement jobs—get into the auto game—the field of unlimited opportunities—of big pay—of independence. Thousands of jobs are open, paying from $150 to $500 a month on salaries—and the sky is the limit if you go into business for yourself.

McSweeny Trained Men Are In Demand

A man who has completed the course taught in either of my schools finds the doors of the automobile, tractor and battery businesses open to him. "McSweeny Trained" means a real job at real money. Thousands of my former students who now own their own business won't hire any but McSweeny trained men. They know!

$86,000 Made by a McSweeny Trained Man Last Year!

A. J. Beall, Jr., Morgantown, W. Va., made $86,000 last year with his garage and service station. Geo. W. Smith, W. Alexandria, O., makes over $800 a month. Thousands of others are making from $50 to $150 a week.

You Learn by Doing Actual Jobs

You can't learn any profession out of books, you can learn *why*, but never *how*. I teach you both the *why* and the *how* by doing actual jobs on the most modern equipment. That's why you can walk out of my schools into big paying jobs.

Aren't You Just as Good as They Are?

Would you admit to anyone, even to yourself, that these men are any brighter or cleverer than you? I know them—and I'll bet they aren't—the only difference is that they *know how*. Spend eight weeks in either of my two big schools and I'll teach you the same things that have made them big money makers.

Decide Today—Your Entire Future Lies in the Balance

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Dry "B" Batteries are more economical and more dependable than any other source of plate current!
REDUCE
Operating Costs
THOUSANDS of people are already cutting their "B" Battery costs one-half, or even two-thirds, by using the new Eveready "B" Battery No. 770 on their heavy drain sets.
This new Eveready Heavy Duty Battery marks a marvelous advance in reducing "B" Battery costs.
If your "B" Batteries have lasted only two months on a five or six tube receiver, this Eveready Heavy Duty "B" Battery will increase the service two to three times.
Use this Eveready Heavy Duty "B" Battery on any receiving set on which the "B" Batteries last less than four months. When thus used to its full capacity, it is the cheapest as well as the best source of "B" energy ever offered.
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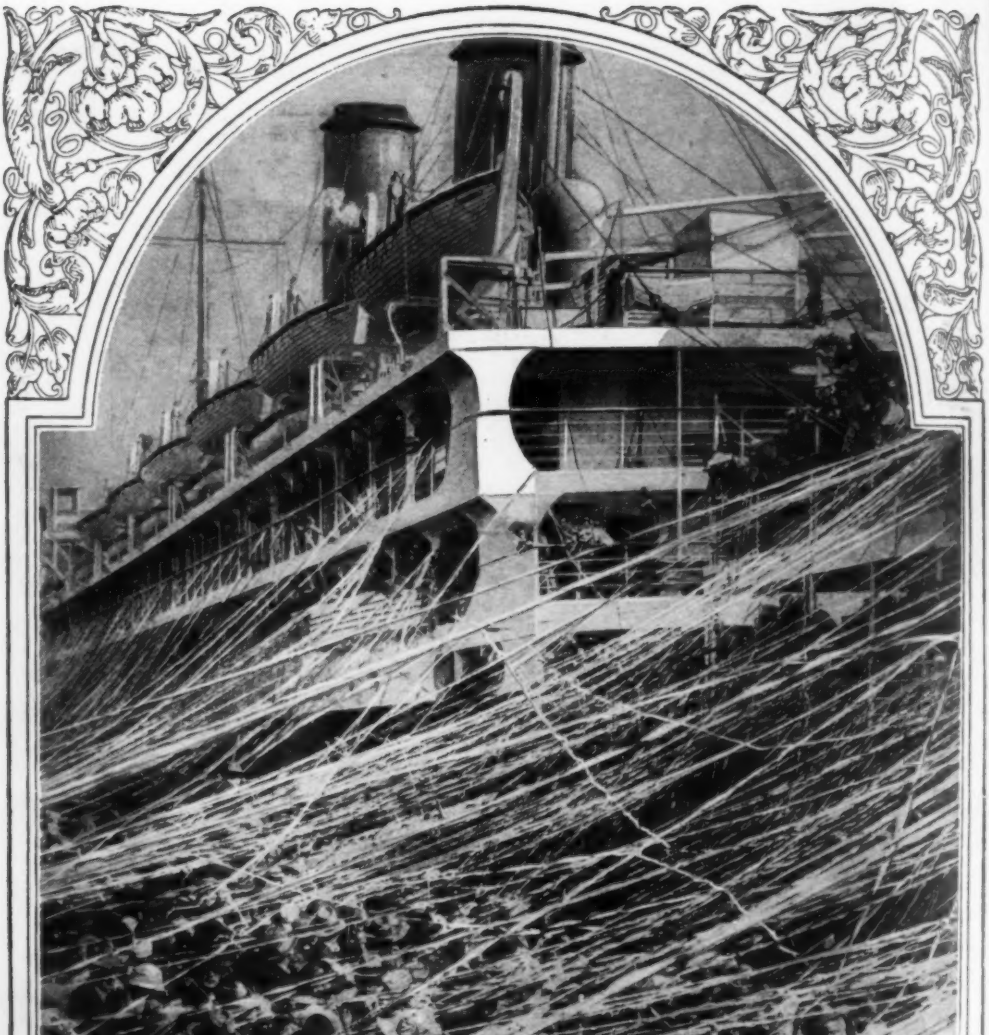

Courtesy The Illustrated London News

Multicolored Paper Streamers Link Liner to Shore at Sydney, Australia; One of the Ceremonies That Mark the Romance of a Ship Putting Out to Sea—See Page 929

Popular Mechanics Magazine
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WRITTEN SO YOU CAN UNDERSTAND IT
Vol. 42 DECEMBER, 1924 No. 6

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Clusters of Amplifiers Suspended above Vast Audiences Clearly Transmit the Voices of Distant Speakers Whose Every Word Is Distinctly Received by Hearers Often Hundreds of Miles Away

Political Spellbinding by Radio

ONE hundred and ten million Americans will have the opportunity next March of listening to the inauguration of the first ruler of any nation to be chosen after a radio campaign. While thousands heard the three presidential candidates in person, millions more at some time or other during the campaign heard their voices over the radio, and that same opportunity will be extended when the inaugural address is delivered. The old-fashioned spellbinder climbed down off the stump in this campaign of 1924 and settled himself in front of a microphone, and incidentally some of the political speakers had to fit themselves to an entirely new form of public speaking. Picturesque and vivid personalities are lost on the radio audience. The speaker's individuality counts for nothing, and what he says for everything when the listener is sitting a hundred or a thousand miles away. Words have displaced gestures as vote getters. In the past, no matter how poor the speaker, he usually found that the voters who were interested enough to turn out to hear him would stay to the finish, whether they liked his arguments or not. This year the voter had but to move a dial a fraction of an inch and pick up a jazz band or a dramatic recitation instead. Getting the radio message of the rival candidates for pres-

President Coolidge's Messages Frequently Reach Remote Hamlets through Radio Loud Speakers

ident before the nation involved a triumph of electrical ingenuity. Only four years ago, in the Harding-Cox campaign, the number of listeners who could hear a public speech had been raised from a few hundred within sound of the speaker's voice, to many thousands, through use of the public-address system of amplifiers.

In four short years, the possible audience has leaped from thousands to millions through the development of radio broadcasting. Herbert Hoover estimates there are 5,000,000 radio-receiving sets in operation in the United States, with an average of three listeners for each. Other experts double those figures.

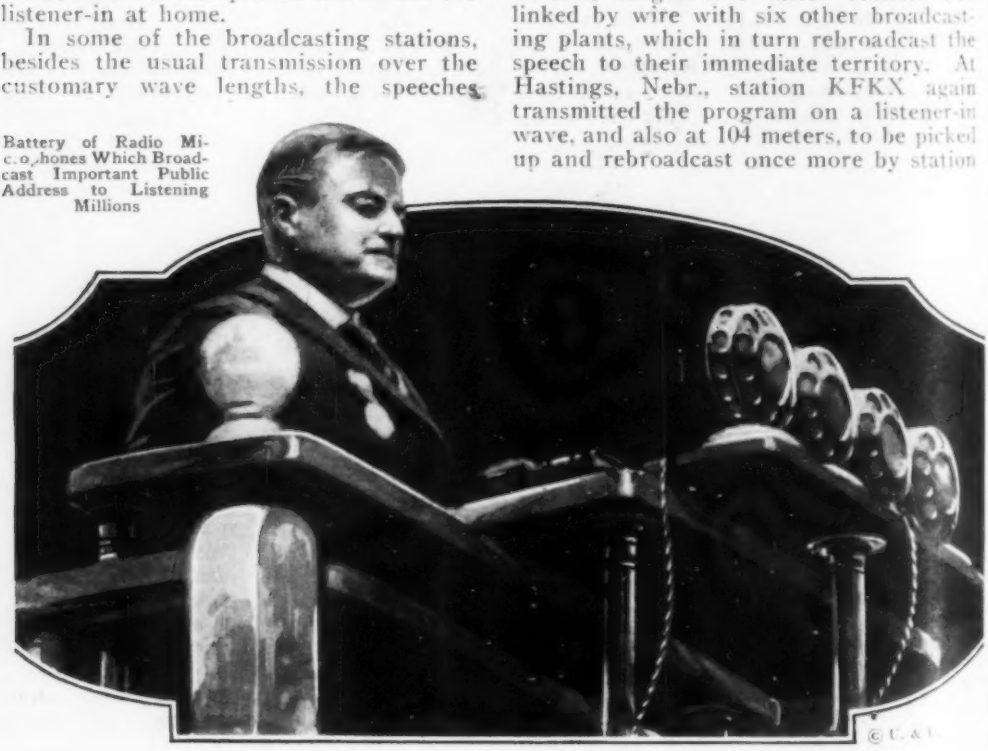
In the 1924 campaign, beginning with the political conventions in Cleveland and New York, radio, telephone and telegraph facilities were all linked together to carry the speeches from one end of the country to the other, and to England, too, if England cared to listen.

In the convention halls and about the platforms where the candidates addressed the crowds were amplifiers to enable 50,000 or more people, covering several acres of space, to hear every word of the speaker. From the platform delicate microphones carried the speech over telephone circuits to broadcasting stations in far distant cities, where it was put on the air for the listener-in at home.

In some of the broadcasting stations, besides the usual transmission over the customary wave lengths, the speeches were transformed into a short wave length, at high frequency, and distributed to distant stations, where they were picked up and rebroadcast on a wave length which receiving sets could pick up. The carrier wave of the short-wave high-frequency transmitter is inaudible to the average receiving set, and so did not interfere. In one case, a speech delivered in New York was broadcast through five stations, each getting the program out of the air on one wave length and putting it back on another. Station WJZ had its microphones on the speaker's table and carried the program to the station by direct wire. There it was broadcast to listeners around New York city on a 455-meter wave length, while a lead from the amplifier panel carried it over a land wire to WGY, at Schenectady, N. Y.

From that wire WGY sent the program out through two different transmitters, one on the customary 360-meter length, and the other on the high-frequency 100-meter wave. This wave, inaudible to the listener-in, was picked up at station KDKA, at East Pittsburgh, and broadcast, once on the usual 326-meter length for listeners-in, and again at 98 meters, as a carrier wave to KFKX, a repeater station at Hastings, Nebr., and to 2-AC, in Manchester, Eng. The latter station was linked by wire with six other broadcasting plants, which in turn rebroadcast the speech to their immediate territory. At Hastings, Nebr., station KFKX again transmitted the program on a listener-in wave, and also at 104 meters, to be picked up and rebroadcast once more by station

Battery of Radio Microphones Which Broadcast Important Public Address to Listening Millions



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Magnifiers Installed to Aid Orators at Open-Air Assembly to Reach Hearers Hundreds of Feet Away; Below, Speaker's Stand in Arlington Cemetery

KGO, at Oakland, Calif. The linking of radio broadcasting stations by land wires proved equally effective, and as remarkable. For the democratic convention at New York, the republican convention at Cleveland, and for the principal addresses of the candidates during the campaign no less than eighteen stations were joined by telephone wires to broadcast the speeches simultaneously. Microphones at the conventions were scattered through the hall, on the speaker's stand, in the galleries, before the band, and in the announcer's booth. Only one microphone was used at a time, but by manipulating a silent switch, the control operator could carry to his invisible audience the speech or music, the rapping of the chairman's gavel or the roars of the crowd.

Swinging from one microphone to another like an organist manipulating the stops of a mighty organ, he put the high lights and shadows of the convention picture into sound waves that carried the entire story so perfectly that only an occasional word or two was needed from him to fill in the gaps. Just preceding the advent of the central announcer on the air, each local broadcasting station in the far-spread chain made its own announcement. They were told when by a telegraph wire running from the convention hall.

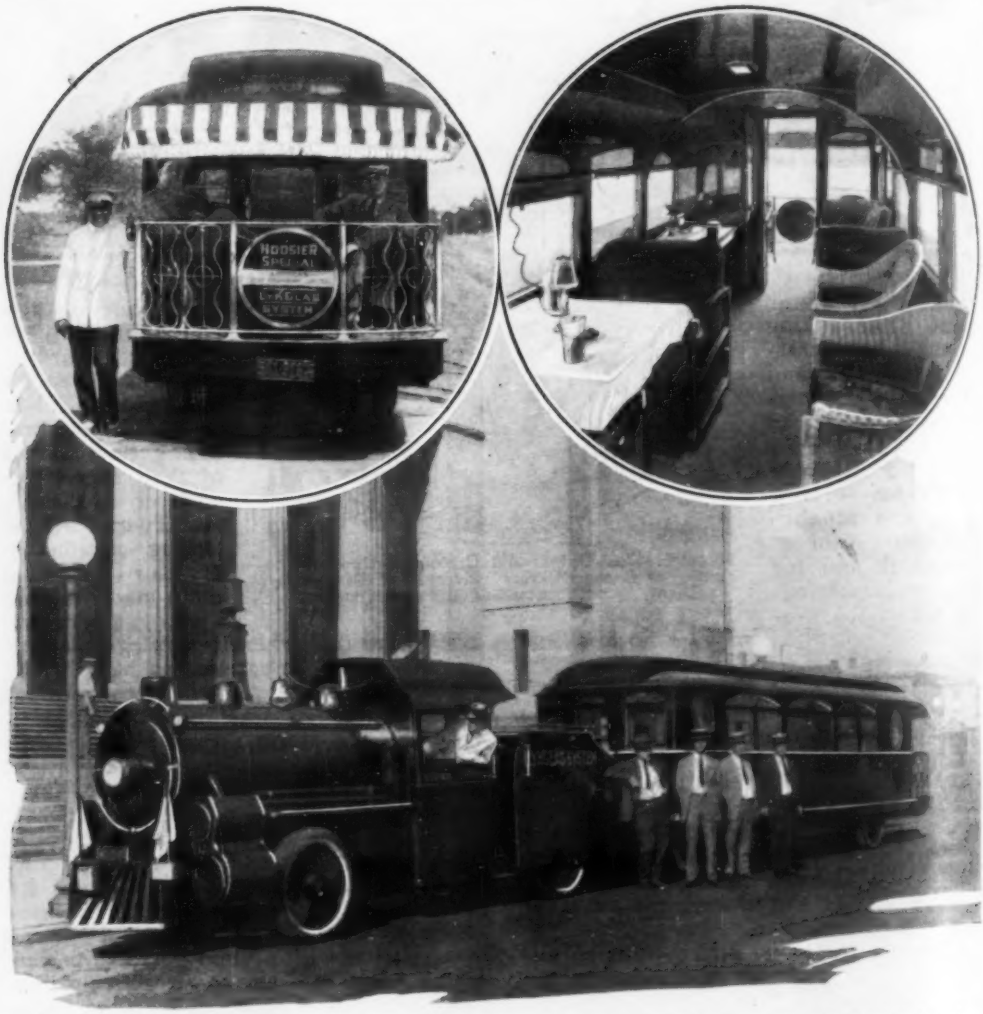
Once, during the republican convention, the broadcasting was interrupted for a time when a storm struck several Ohio cities, making it necessary to use all available wires to dispatch relief expeditions and bring out the story of the stricken towns. Radio, however, has done more for politics than merely bring the candidate's message to millions. Perhaps its greatest contribution has been the elimination of empty phrases.

A speaker with a vivid personality can say nothing, and say it attractively, but the man who tries to deliver the same speech to the radio, where only words count, is doomed to failure.

TRACKLESS TRAIN PROVIDES HIGHWAY LUXURY

To add effectiveness to an accident-prevention campaign, a luxurious trackless motor train, consisting of a realistic imitation of a steam locomotive and a buffet-parlor car, each equipped with a ninety-horsepower gasoline engine, has been constructed for a cross-country tour.

The coach is slightly more than twenty-eight feet long, eighty-six inches wide, has a wheelbase of 198 inches and is constructed of heavy oak, reinforced with steel. A four-inch flange around the chassis protects it against bumps. The motor, instrument board, pedals and steering parts are cleverly concealed under a buffet cabinet in a forward compartment that may be used by the driver or turned into a kitchen with an electric stove. Trimmed with mahogany and blue velour, the car is provided with comfortable wicker chairs, folding seats, a bed and writing desks, and is electrically lighted. At the rear is a roomy brass-lined observation platform, and a radio set with a range of 6,000 miles and a concealed aerial is an added luxury. Underneath the coach are four compartments for baggage and tanks for water and air. A feature of the train is the hydraulic-braking installation. This is controlled entirely from the engine, although the coach has a separate brake for use when it is operated alone.



Views of Trackless Motor Train, Showing Realistic Locomotive and Parlor Car Luxuriously Equipped with Easy-Chairs, Roomy Tables and Observation Platform for Cross-Country Safety Tour

Big Coal Deposits Found in Arctic Five Hundred Miles from Pole

Coal beds twenty-five feet in thickness were found only 520 miles from the North Pole, by Capt. Donald B. MacMillan, on his trip to the far north. The deposits, however, are not available for immediate use, being 800 miles beyond reach of any transportation except by dog sled. The presence of the coal, however, proves that the far north was once covered by heavy vegetation. Shifting of the earth's poles, bringing down succeeding glacial areas, produced the change. Dr MacMillan found evidence that such a shift it going on now. The glacial ice cap is growing thicker and advancing farther every year, he reports, and has been doing so for over seventy years. Within his own experience in the arctic, inland glaciers have advanced to the sea, producing more icebergs each year.

Typewriter with Piano Keyboard Helps in Transcribing Music

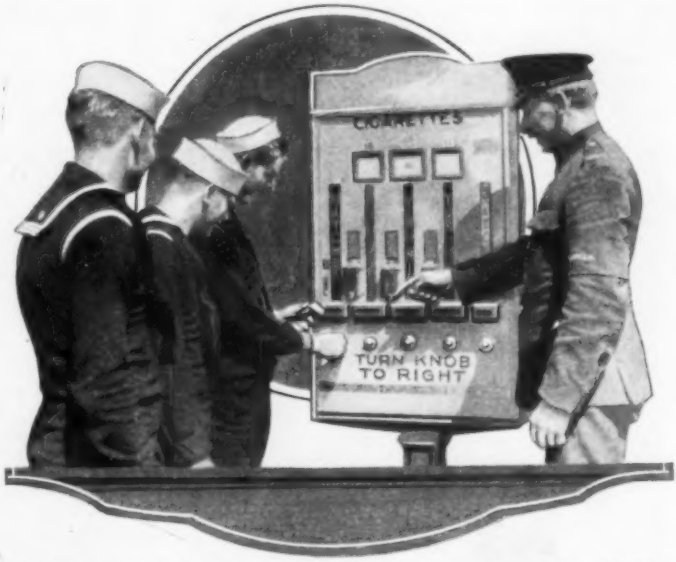
Copying music from the composer's notes is said to be greatly simplified with a typewriter arrangement devised by an eastern inventor. It consists of a portable keyboard, an exact duplicate of that on a piano, and an electrically operated transcribing apparatus somewhat similar to the mechanism of a regular writing machine. To operate it, the keyboard is placed on the piano or on a table or desk, and as it is "played," the notes are transcribed on a roll in the recording instrument.

Copyright, Keystone View Co.

Music Typewriter with Its Portable Piano Keyboard

Slot Machine Serves Cigarets When Stores Are Closed

Slot machines for vending cigarets and matches in London are a welcome novelty to visitors. The mechanism is operated in the usual way by inserting a coin and turning a knob. There are spaces for different grades of tobacco.



Visiting American Sailors Learning to Operate the Cigaret Slot Machine

Odor of Metals Due to Gases

Experiments have been made to prove that metals have odors composed not of the atoms of the metal, but of the products of their chemical changes. At ordinary temperatures the odors frequently could not be detected or were almost imperceptible, but became more pronounced as the metal was heated, and then disappeared after the heating had been continued for a considerable length of time. The experimenters also have succeeded in isolating the odorous matter.

Night Golf with Luminous Balls Played on Lighted Course

Using balls and hole pins coated with phosphorescent paint, players of night golf now follow their drives almost as easily as in the daytime. The cups on the greens are indicated by luminous standards which are visible in darkness at great distances, while tees are marked with incandescent bulbs on upright sticks. The same implements can be used for both daylight and evening games, as the paint does not easily wear off. Besides aiding players to keep in good form, night games increase playing time for those otherwise limited to the early evening hours.

Popular Movie Stars Playing Night Golf with Luminous Balls They Drive to Greens Marked by Phosphorescent Hole Pins

Collapsible Metal Air Chambers to Make Ships Nonsinkable

Working models of a device using collapsible metal chambers intended to keep ships from sinking in storms, collisions or by explosions or torpedoes have been demonstrated in the east. Their inventor claims that they can be installed on a vessel without sacrificing any of the space used for essential purposes and at a cost not greater than the amount of one year's insurance on the ship.

Mimic Train Robbery Tests Mail Car Equipped to Repel Bandits

By staging a modern night holdup of a mail train to test the efficiency of a postal car equipped for defense against robbers, government officials proved the ability of the occupants to fight off attacks of bandits with little danger to themselves or the postal matter carried. The scene of the mimic battle was laid along an isolated section of the New York Central railroad, and was selected for its resemblance to territories where genuine robberies have occurred in the past. When the band opened their attack on the car the clerks within inserted bright, automatically lighted flares through holes in the steel sides, illuminating the ground for several hundred feet around and bringing into view every one of the opposing figures. Wired, bullet-proof windows foiled attempts of the "robbers" to make an opening into the interior, while swivel, shot-proof loopholes enabled the defenders to pour rifle fire in almost any direction. To drive off any assailants who might run in close to the car and crouch out of range of the loopholes, a cone-shaped steel spreader fastened to the bottom deflects bullets fired from within through an armored hole in the floor, scattering them on a level with the attackers' legs. It is said the imitation holdup resulted in the "entire destruction of the highwaymen." Hundreds of rounds of blank cartridges were used in the test, and six men made up the bandit gang who first boarded the locomotive and "overpowered" the engine crew before rushing the armored car. Motion pictures of the affair were taken for future study of robber tactics. So successful was the defense on the part of the postal clerks in charge of the car that, it is reported, 3,000 mail cars are to be fitted with similar apparatus to prevent losses from banditry in the future.

¶ America imports about $20,000,000 worth of bananas a year.

Staging a Mimic Battle between "Bandits" and Crew of Armored Mail Car to Test Ability of Defenders to Prevent Robberies

Skeleton Is Adopted as Symbol by Fliers of "Jinx" Air Fleet

To show their unbelief in the influence the squadron number thirteen may have on the luck of the unit, aviators of the

Flier of Thirteenth Air Squadron and His Plane Adorned with Skeleton Insigne of "Jinx"

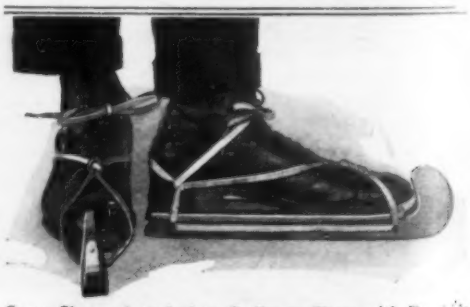
organization have adopted the skeleton as their insigne. Each airplane is adorned with a large, bright painting of the "grim reaper," scythe in hand, which can be readily seen at considerable distance. One of the craft bearing the symbol was successfully piloted through a severe storm and landed at the home field without damage to operators or ship.

Steam at Twelve Hundred Degrees Drives Torpedo's Power Plant

In the small but mighty steam-power plant that sends torpedoes plunging through the seas, engineers see possibilities of vastly increasing the efficiency of stationary plants in industry. Tremendous obstacles are in the way and the whole matter is largely theoretical. However, during the last decade there has been an average yearly increase of about fifteen degrees steam temperature in land use and the rate for the future is expected to be more rapid. The torpedo power plant weighs only twenty pounds, and its boiler is about eight inches long. It operates with steam heated to 1,200 degrees Fahrenheit at 350 pounds' pressure. When it is remembered that iron gets cherry-red at this heat and can be shaped with a blacksmith's hammer, the fact that this diminutive power plant can function at such high pressure and develop between 100 and 200 horsepower with its tiny turbine, is considered all the more remarkable. A mixture of air, compressed to 2,600 pounds to the square inch, and water is directed into a flame of atomized alcohol to generate the steam. To prevent overheating, water is sprayed into the mixture after combustion has occurred. This brings the temperature from 1,600 degrees, which would otherwise be developed and could not be used, to about 1,200 degrees. The heated gases escape at the top of the chamber to the turbine wheel which is about eleven inches in diameter and is turned at 11,000 revolutions per minute. Unlike stationary plants, this small unit is required to operate only for about five minutes at a time. Its life is only from fifty to 200 hours without repairs, and efficiency has not been a special objective as is the case in larger turbines. Furthermore, the cooling effect produced by the water in which the torpedo is submerged, would be difficult to realize in a land plant.

Snow Skates to Add a New Thrill to Winter Sports

Skates for use in snow have been designed to add another thrill to the list of winter sports. Strongly constructed of straight-grained hickory treated with oil, they are said to hold the weight of the heaviest adult while being light enough not to tire children. The runners are of rustless steel and the top is covered with corrugated rubber to provide a non-slip surface. The skates are attached to ordinary shoes with rawhide straps and may be used more months a year because there is no waiting for ice.



Snow Skates Attached to Ordinary Shoes with Rawhide Straps Are Held on Firmly

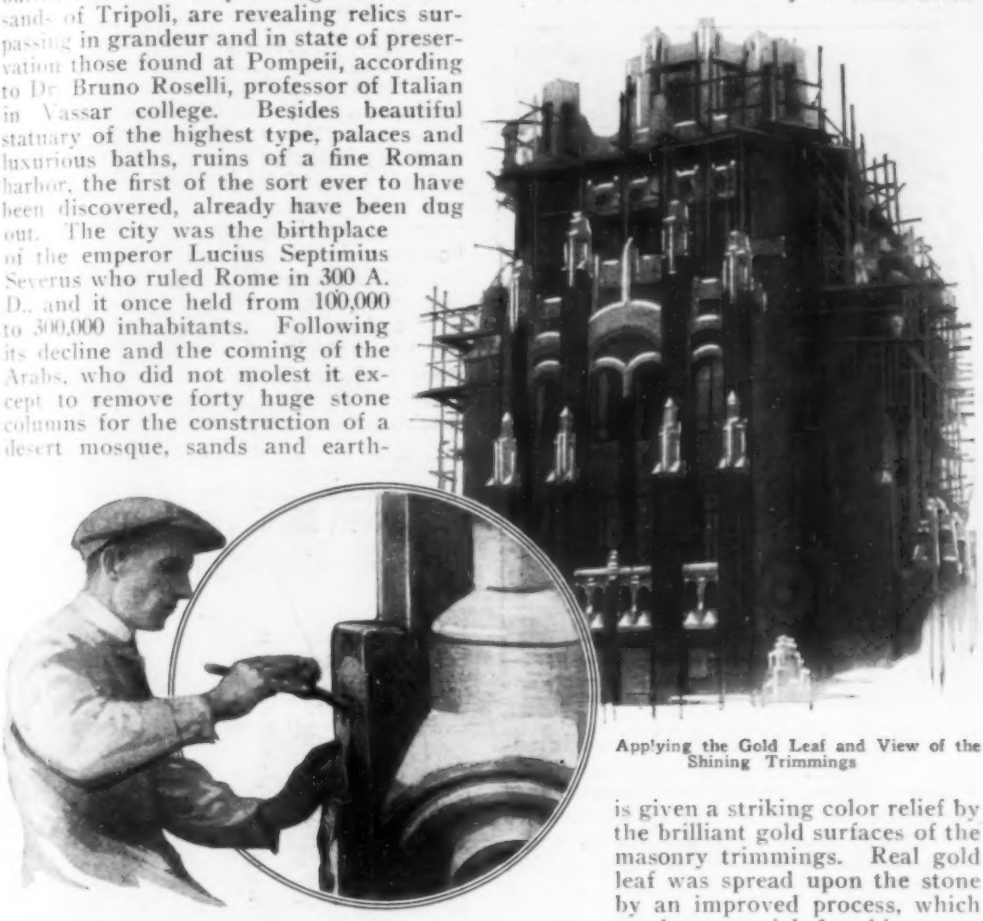
Ruins of Pompeii Rivaled in City Found beneath Sahara Sands

Excavations now being made on the site of Leptis Magna, an ancient Roman city buried hundreds of years ago under the sands of Tripoli, are revealing relics surpassing in grandeur and in state of preservation those found at Pompeii, according to Dr. Bruno Roselli, professor of Italian in Vassar college. Besides beautiful statuary of the highest type, palaces and luxurious baths, ruins of a fine Roman harbor, the first of the sort ever to have been discovered, already have been dug out. The city was the birthplace of the emperor Lucius Septimius Severus who ruled Rome in 300 A. D., and it once held from 100,000 to 300,000 inhabitants. Following its decline and the coming of the Arabs, who did not molest it except to remove forty huge stone columns for the construction of a desert mosque, sands and earthquakes contributed to its ruin and it was finally swallowed up. Only the tops of the columns were left protruding and these were discovered eighty years ago. Not until after the world war, has excavation been attempted on any large scale. Among the buildings that have been uncovered are the palace of the emperor, warehouses that held grain for shipments to Rome and a number of dwellings.

The construction of the harbor is being studied with great interest as, up to this time, archæologists are said to have been puzzled as to the methods used by the Romans in building their quays and docks. The work of removing the sand is being done by Arab prisoners of war and is expected to be completed in two years.

Gold-Plated Stones on Skyscraper Add Beauty to Structure

Lifting its somber bulk above the sidewalks of an eastern city, a big building constructed almost wholly of black brick is given a striking color relief by the brilliant gold surfaces of the masonry trimmings. Real gold leaf was spread upon the stone by an improved process, which employs special brushing machines. Coatings of varnish were later applied to make the plating waterproof.



Applying the Gold Leaf and View of the Shining Trimmings

Clock without a Face

Striking the hours on the bell of the church over which it is hung, a wooden clock without face or hands has counted time for a London community for nearly 400 years. Made by a village blacksmith in the sixteenth century, the timepiece is of the crudest type but strongly constructed throughout. The winding gears are cut from heavy oak, and iron is used for the bearings. Recently some new metal parts and striking pins were placed in the clock which, experts declare, should continue to give accurate time for years.

Mirror Signboard at Sharp Curve Prevents Auto Accidents

For the protection of motorists at a dangerous curve on an English highway, a large double mirror has been erected.

As Car Nears Curve, the Big Signboard Mirror Warns the Driver That Another Is Approaching

It is set at such an angle that traffic approaching from either direction is visible at some distance to a driver going toward the curve so that he has ample time to turn out or slacken speed. The arrangement is said to have reduced the number of accidents at this spot.

Heat of Breath Is Able to Release Power to Lift Many Tons

For automatic control of steam pressures, temperatures of rooms, electric currents and other factors, a mechanical regulator that takes the place of a man in a large industrial plant has been invented by a Swedish engineer. It is so sensitive that the breath of a child directed into a funnel or the heat from a man's hand held several inches away, will cause it to release sufficient energy to lift many tons. Its secret is based on the expansion and contraction of a strip of ebonite by heat or the swelling and shrinking of bands of cotton threads under different changes of humidity. These slight movements actuate the end of a lever controlling hydraulic pressure that opens or shuts the proper valves.

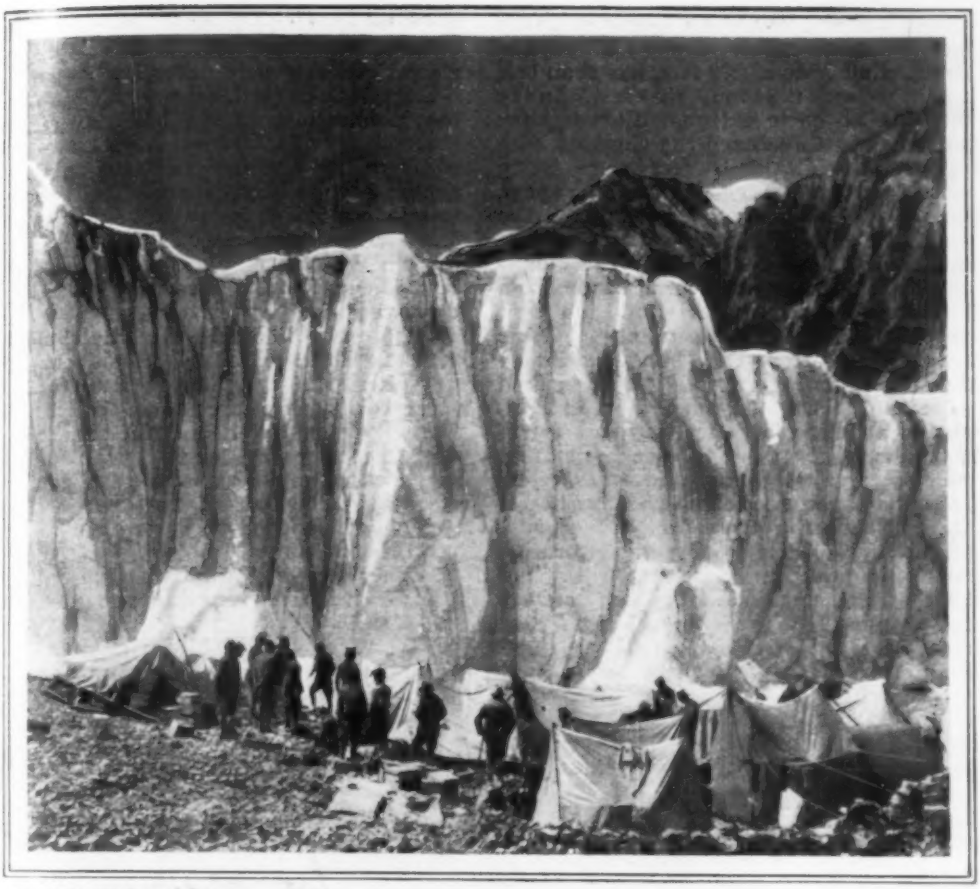
Elevators' Speed Set by Machine That Serves as "Traffic Cop"

Skyscraper elevators can be built to operate in safety at mile-a-minute speed, but are not because the passenger's inner economy is not built to stand such sudden drops. Instead, about 600 feet a minute, or a mile in seven minutes, is the highest practical working speed. The makers, however, do not rely upon the inner feelings of passengers to regulate the speed. An automatic governor acts as "traffic cop" to keep the operator from exceeding the speed limit. Elevators, incidentally, start and stop much more quickly than vehicles traveling horizontally, and can reach maximum speed within a few feet.

Pneumatic Tire for Giant Aircraft Will Support Ten Tons

Constructed to withstand a load of ten tons when inflated to a pressure of seventy-five pounds, what is said to be the largest pneumatic tire in the world has been completed for the United States army air service. It is sixty-four by fourteen inches and it is expected that it will be used on the alighting gear of large airplanes.

There's Room for Young Woman, and Some to Spare, in Giant Aircraft Tire



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Explorers' Supply Camp Built on Solid Ice at "Top o' the World" Where Glacial Walls and Jagged Peaks Form Barriers to Perilous Climb toward Everest's Cloud-Draped Summit

New Climb Planned to Conquer Everest

Explorers, Undeterred by Loss of Two Companions, Determined to Go Back Again to Scale the Roof of the World

UNDAUNTED by the tragedy that claimed the lives of two members of the 1924 Mount Everest expedition, the survivors are already preparing for another assault on the highest peak of the world, to be made in 1926. Swiss alpine climbers also are planning an expedition, but will make the attempt in 1925 in an effort to beat their English rivals.

With both the earth's poles visited, the deserts crossed and lesser mountains scaled, Everest alone continues to defy man's efforts. Rearing its head 29,002 feet above sea level, the great peak was thrown open to mountain climbers after the war, when, in 1920, the Dalai Lama issued permission for an expedition to attempt the ascent. On his warrant the mountain is given its Tibetan name, Cha-ma-lung-mo, meaning "the place where it is so high that even a bird goes blind when he gets there." Acting on this permission, the first Everest expedition went out in 1921, ascended to a height of 22,000 feet and brought back valuable maps and data—but left one of its members in a grave in a 17,000-foot pass, the first victim to the high altitude. In 1922, the second expedition, following the same trail, pushed farther ahead and three men, including George

Leigh Mallory, reached a height of 26,800 feet, while two others, armed with oxygen tanks, climbed to 27,300 feet, less than half a mile beneath the mountain crest. In the thin air at such extreme altitudes the burning sun threatened the climbers with sunstroke while their feet were being frostbitten on the glacial ice and snow. Before the work could be completed the dreaded monsoon season set in and terrible snowstorms swept across the mountain face, followed by warm winds from India which melted the snow and sent avalanches cascading down the slope. One avalanche swept seven Tibetan porters to their death and the expedition was forced to retreat. The third expedition, in 1924, was equipped with better oxygen apparatus and supplies, while the backbone of its man power was Mallory and other veterans of the preceding climbs. After heartbreaking effort, a camp was pitched at a height of 27,000 feet. Several efforts to scale the peak were frustrated by bad weather, and finally Mallory, the veteran, and a young college student named Irvine attempted the dash for the summit. Later the same day, when the clouds on the peak lifted, their companions at the 27,000-foot camp saw the two toiling up a little ridge at the 28,200-foot level, barely 800 feet below the summit. Then the storm clouds closed in—and they were never seen again. Whether they actually reached the summit, and perished there of cold and hunger, succumbed to exhaustion on the ridge, or fell into some glacial crevasse may never be known.

Doctor Somervell, who with Col. Norton, commander of the 1924 expedition, reached the 28,000-foot level, says the effort required to move at that height is almost beyond comprehension. In order to take a single step forward a man must first take ten deep breaths to get enough oxygen into his lungs. Each step, he says, is equal to the exertion required for a 100-yard dash at sea level.

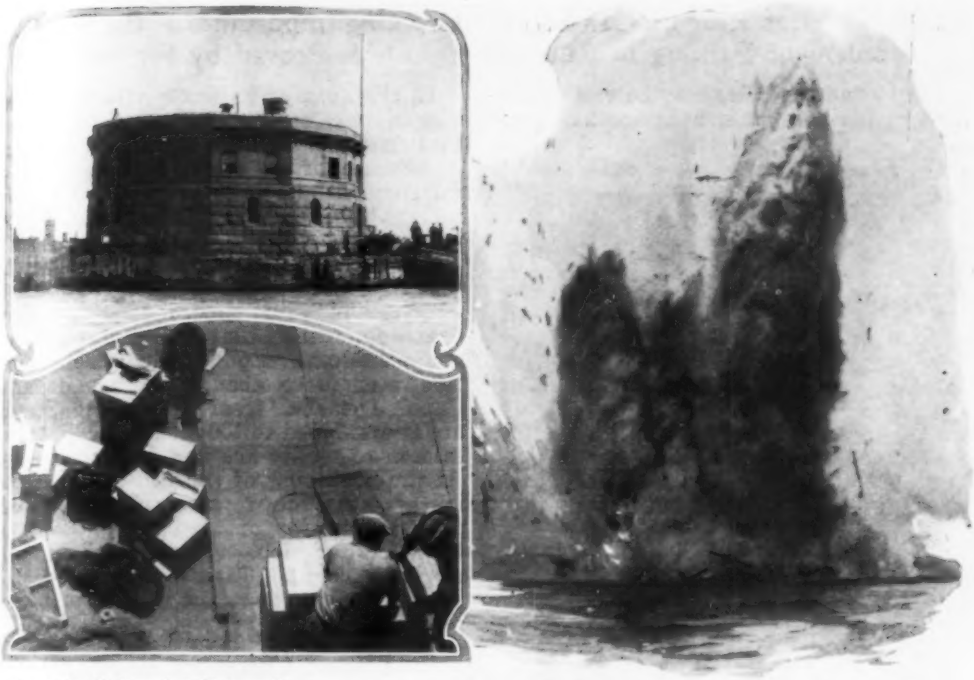
Despite the difficulties, veteran climbers of the Alpine club are confident that Everest will be conquered. Hundreds of volunteers have offered their services for the next attempt, but only the pick of the world's athletes are eligible. The members of the expedition must practice constantly to keep in trim, and even a brief rest entails months of hard work to get back in condition.

While lecturing in America raising funds for the third expedition the ill-fated Mallory astonished crowds by climbing up fire escapes, hanging from the lower side by his hands. That was only part of his daily exercise. He suggested at that time that it might be necessary to send an expedition to live on the slopes of Everest above the 20,000-foot level for a year or two to thoroughly acclimate themselves.

But the natives living near by are sure the spirit of the mountain will never be conquered by man.

© The Times

Monument Erected near Base of Mt. Everest in Memory of Intrepid Scientists and Faithful Porters Whose Lives Were Lost in Three Expeditions



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Old Crib before the Blast; Unpacking the Dynamite; and Geyser That Crashed Skyward When the Heaviest Charge Exploded, Leaving Only a Heap of Crumbled Ruins

Six Thousand Pounds of Dynamite Used to Destroy Lake Crib

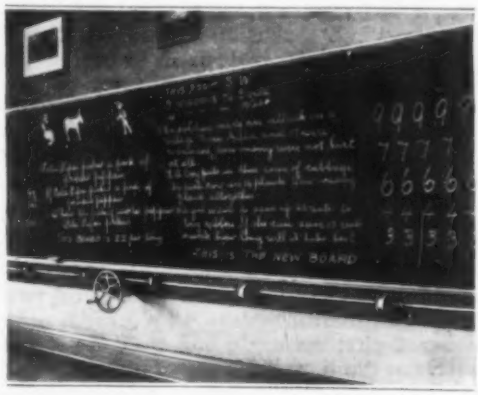
Wreckers employed to destroy an abandoned water crib, two miles from shore in Lake Michigan, saved much time and labor by setting off six thousand pounds of dynamite under the brick and stone. Several shots were fired, a final charge lifting tons of water and debris high into the air and reducing the ancient structure to a heap of crumbled ruins. The shots were fired by electrical means.

Grass Growing by Electricity

Electric lights have been used successfully at the Jumping Brook golf club, in New Jersey, to grow grass on the greens at night, and thus shorten the delay in putting the course into service. Grass lighted at night grew four inches in three weeks, while grass on the unlighted portion of the green grew but one inch in the same period. Twenty-four thousand-watt globes with special reflectors were hung four feet from the ground to give a continuous, even spread of light. On the lighted portion the seed came through in five days, while seed sown on the unlighted part of the same green did not germinate until two days later.

Blackboard Tilts to Ease Eyestrain on Pupils in Classroom

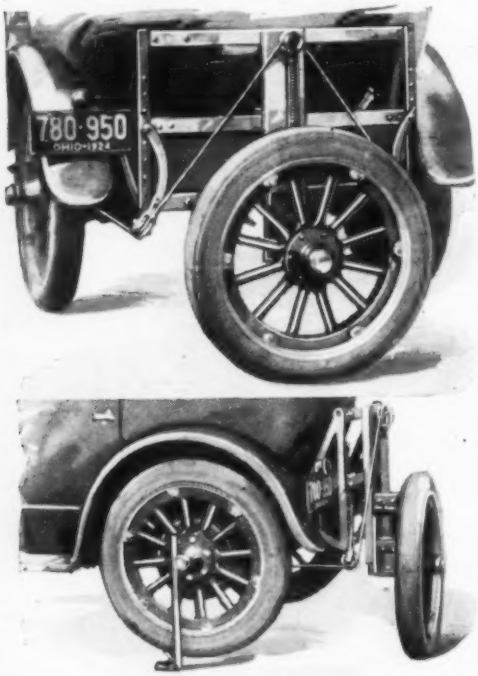
By tilting the schoolroom blackboard on a patented shaft holder, glare is eliminated and students are spared the eyestrain frequently caused by improper lighting. The apparatus can be quickly fitted to any board and is so adjusted that a child can tilt a heavy length of slate to the proper angle with the aid of a wheel on the bottom. With this device, it is not necessary to darken the room to stop the glare.



Blackboard Tilted to Give Proper Light and Aid Vision of Students

Spare Wheel at Rear of Car Solves Problem of Parking in Jam

So that automobiles may be easily handled in parking jams, a device has been



Views of Spare Wheel Used as Rudder to Steer Car in Traffic Jams

invented which makes use of a spare wheel carried on the rear of the machine. Special apparatus attached to a lifting jack, which is connected by wires to the instrument board, holds the wheel. When the car cannot be driven forward or backward, a turn of the lever will cause the jack to lower the wheel, raising the back of the car a few inches from the ground. Another switch makes the spare revolve to the right or left as desired, swinging the rear of the car to an angle of forty-five degrees from the line of parking. The machine can then be easily backed out. A pulley and cable attached to the motor furnish the power for both operations, which require but a minute.

¶ Telephone-line trouble shooters, searching for the cause of the failure of two trans-continental wires in Nevada, discovered that an eagle had built its home between the lines. Pieces of metal among the material of which the nest was built had caused a short circuit.

Growing Importance of the Tin Can Is Proved by Figures

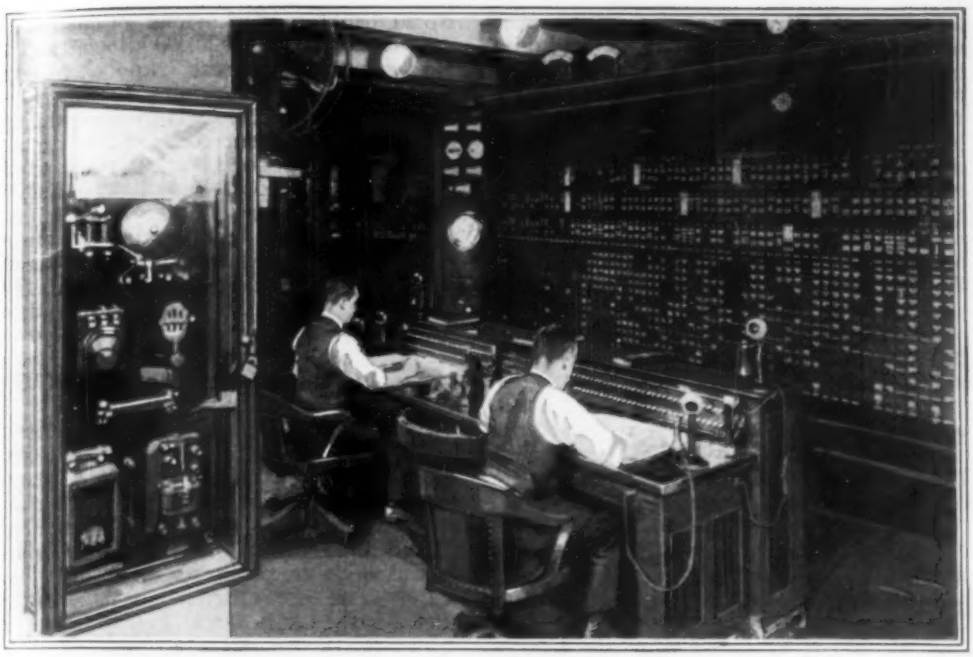
In the light of its utility, the lowly tin can is considered one of the most important articles in modern commerce. Largely because of its efficiency, the canning industry with its millions of invested capital is possible and the United States is able to export products to all parts of the world. The value of canned foodstuffs that passed through ports of continental America in 1923 exceeded $100,000,000, nearly four times that of the year before, while the total output for local consumption was more than a billion dollars. Canned peaches from the United States are now shipped to 100 different countries, salmon to eighty-five and beef to eighty. At the beginning of the can-manufacturing business, the work was done by hand and sixty were considered a good day's work for one man. Now, a large factory can turn out 9,000,000 a week.

Waste Steam Used in Advertising Shows Coffeepot Boiling

Waste steam from the exhaust of a laundry in a southern town has been put to good use for advertising to call attention to a display announcing a brand of coffee. The sign occupies one whole side of the laundry building and depicts two children seated at a breakfast table while from the spout of a large, mock-percolator, the fumes of steam piped to the nozzle

Cozily Steaming from Laundry Exhaust, This Coffeepot Attracts Attention to Sign

from the exhaust catch the eye several blocks away and forcibly emphasize the advertisement of the coffee.



Power Dispatching Board in Big City Electric Plant; Lighted Signal Lamps Indicate to Operators Where Current Is Needed and Where It Is Available for Immediate Transfer

Radio Static Used as Weather Warning

Wireless Fan's Jinx Harnessed by Power Company to Tell in Advance When Rain Clouds Will Increase Demand for Lights

STATIC electricity, the bugbear of the radio fan, has been harnessed in a big electric-light plant to give automatic warning, hours in advance, of an approaching storm whose dark rain clouds will cause a sudden demand for an enormously increased volume of current.

The radio storm detector has replaced an observer who formerly was employed to stand on the roof and watch for approaching clouds. Besides being automatic in operation and costing little, as compared with the observer's salary, the wireless weatherman is far more efficient, because it can announce storms long before the first signs are visible to human eyes. Without some system of weather observations the arrival of every summer storm would be accompanied, in large cities, by a sudden drop in the candle-power of electric lights. Unlike gas and water—physical materials that may be stored up for emergency use—electricity is manufactured only as needed. In a big steam plant it takes some time to put reserve boilers into service and get sufficient steam to start additional generating units. Unless these preparations have all been made in advance, the normal operating equipment could not carry the load when thousands of additional lights are turned on in homes and offices to dispel the storm darkness.

The radio warning is based on the fact that summer storms are accompanied by electrical disturbances covering a much larger field than the storm itself. These static manifestations are so strong that they whistle, wail and howl through the earphones or loud speaker of a receiving set and drown out ordinary broadcasting.

In converting the static into signals, an ordinary antenna mounted on the roof of the power house is used, while the detector itself consists of a short-circuiting switch, spark gap, coherer, relay and battery; a bell, which also acts as a decoherer; a condenser and a ground connection. The oscillating current set up by the static travels to and from the ground through the spark gap, coherer and condenser. The outfit is arranged so that the

bell automatically varies its signal as the storm approaches. From two to five hours before it arrives, the bell rings at intervals of from five to fifteen minutes. The difference in the advance signal depends on whether the storm is following a straight or roundabout course. The operator in charge of the lighting system regards the ringing at intervals merely as an advance warning, and pays no further attention to it, for it is always possible that the storm may change its direction and pass around the city.

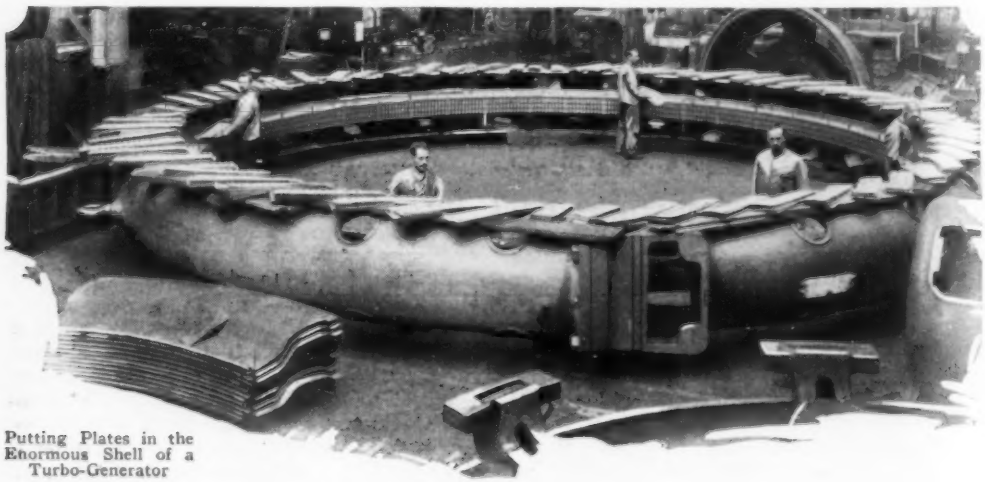
As the clouds approach, however, the bell rings oftener, until, when the storm is less than two hours away, the bell begins striking every half minute. The reserve boilers are then ordered into service, auxiliaries of additional generating units are started, and the generators themselves begin turning over at low speed.

A half hour before the storm is due, the bell unites its periodic strokes with a continuous ringing, though the sky may still remain clear as far as the eye can see. The operator, however, orders the reserve generators synchronized with the service bus wire and prepares to carry the storm load, at the same time short-circuiting the detector to protect the instruments against lightning. A chart record of the bell's operation shows how it worked for a storm which struck the city one day last August. At 8:25 a. m. the signal began tolling every three to five minutes, and kept up that rate until 2:00 p. m. At 2:02, with the sky slightly overcast and the system load totaling 280,000 kilowatts, the bell changed to half-minute intervals, and continued that way until 2:15 p. m., when it began ringing uninterruptedly until it was short-circuited at 3:20 p. m. At 3:45 the storm broke, and the load jumped from 280,000 kilowatts to 420,000 kilowatts. The big generating plants supplying large cities carry an enormous lighting load, which varies by hundreds of thousands of kilowatts at different hours of the day and night. A single one, recently completed on the Mississippi, can light 9,500,000 average-size lights. Some idea of the magnitude of the load carried by one of these plants is gained when it is understood that this middle-western installation has three times the year-around power that the great Muscle Shoals water-power project will develop. It consumes a ton of coal every half minute, and uses 600,000,000 gallons of water a day.

To manufacture the enormous electrical current needed, the last bit of heat value must be extracted from the coal, and for this purpose the fuel is ground to a fine powder that looks and flows like fuel oil. In the furnace this dust acts like gasoline in a carburetor, giving up its heat so completely that instead of the usual cloud of smoke only a thin haze is seen above the tall stacks of the plant.

Needle-Finding Button Saves Cloth and Simplifies Sewing

With a sloping back and large, bell-mouthed perforations, a novel shape of button has been patented to ease the sewer's task and lessen the strain on the cloth. It is so molded that the needle slides easily into the holes on the back side, eliminating useless jabbing. The thread is more widely distributed over the cloth, the inventor claims, and this tends to decrease the pull on the fabric and, therefore, to bind the button more securely.



Putting Plates in the Enormous Shell of a Turbo-Generator

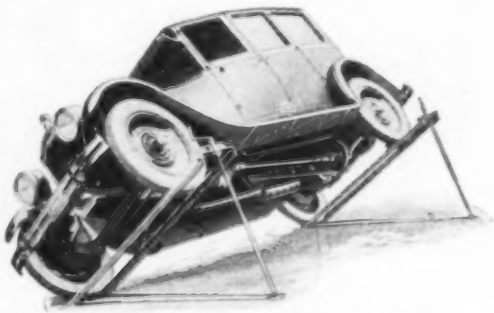
Two Policemen Demonstrating Their Ability to Swim with Ease Although Fully Uniformed, While Giving an Exhibition of Life-Saving Tactics during a Water Tournament at Brighton, England

Policemen Swim in Full Uniform during Life-Saving Stunt

Dressed in full regalia of their calling, policemen staging a life-saving exhibition at Brighton, England, showed they could swim in spite of the weight of water-soaked uniforms and other heavy accouterments. Without removing helmets or shoes and wearing tightly buckled belts and buttoned coats, they dived into the river to "rescue" others of their organization who acted as drowning persons. Using the regulation methods of recovering victims in the throes of drowning, the "bobbies" quickly dragged their burdens through the water to the first-aid stations.

Frames for Tilting Autos on Side Simplify the Making of Repairs

Tilting an automobile so that repairs or adjustments may be made easily on the underside when a pit is not available, is simplified with the aid of two steel frames with swivel screws operated by handles. The automobile is driven upon the frames, which are placed flat on the ground, and as the handles are turned, one side is elevated to any desired angle up to forty degrees, the maximum pitch, which may be reached in five minutes. The repair man thus can easily gain access to almost any part under the car. The automobile is quickly lowered to level position again and the frames, fitting into a compact package, two inches high, fifteen and one-half inches wide and seventy-eight inches long, may be carried in the car if the autoist desires.



Auto Tilted in Swivel Frames to Give Repair Man Access to Under Parts

Detectives Examining Burglar Tools, Including Guns and Acetylene Gas Outfit, Seized in Raid on Safe Blower's Apartment

Beating the Burglar at His Own Game

War-Time Tear Gas Is Added to Equipment Used to Foil Bank Robbers and Expert Safe Crackers

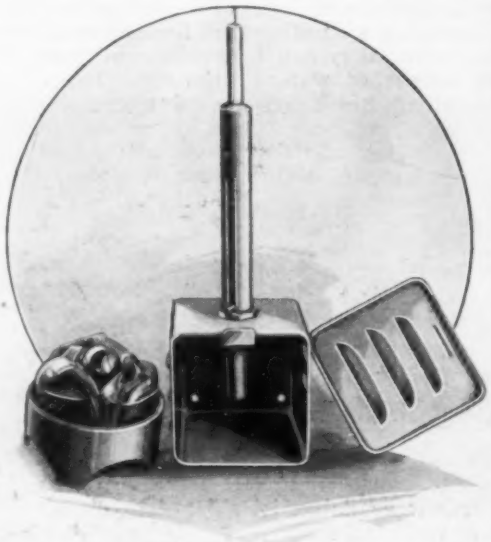
SCIENCE again is a lap ahead of the burglar and safe blower in the eternal race between criminals and the law.

The development of the oxyacetylene torch, coupled with the discovery that a rod of ordinary soft steel would help it burn through the hardest manganese steel ever made, for a time gave the bank robber an advantage.

Then science stepped in and produced a new metal which, so far, has resisted all efforts to melt or drill it. The composition is a closely guarded secret, but copper, apparently, is one of the materials used. Applied to vault doors, a sheet of ordinary hard steel is used on the outside, then a sheet of what appears to be a copper alloy, next a thickness of an exceptionally hard material that looks like carborundum, another sheet of the copper alloy, and finally the inside steel plate.

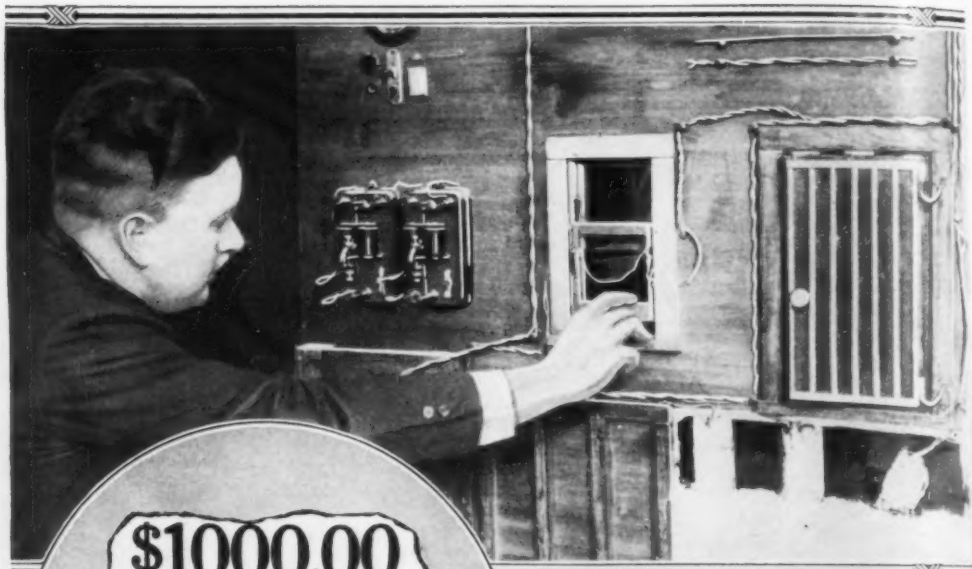
Science has also turned a war-time invention—tear gas—to peace-time use. It does the burglar no good to drill or burn or blast his way into a vault equipped with tear gas, for no matter where he attacks the bank's storehouse, he is bound to release a dense cloud of blinding, choking fumes.

In the last century bank-vault and safe construction kept about twenty-five years ahead of the robber. In other words, a new vault or strong box was good for a quarter of a century of use before the improved technique of the burglar rendered it obsolete. In recent years, however, the use of more complicated appliances by the robber has shortened the safety period considerably. To meet the change, the vault makers have constantly improved their product. When the vaults of the Cleveland federal reserve bank were designed, they were equipped with five-foot thick doors of chilled steel, which alone weighed 40,756 pounds. These were



Tear-Gas Bomb, Showing Gas Vials, Such as Is Used Inside of Bank Vaults

Set Off by Acetylene Torch Which Has Cut through Steel Door, a Tear-Gas Bomb, Placed Inside, Explodes, Compelling Cracksmen to Flee



In Upper Photo, Electrician Is Testing Model of a Central-Office Burglar-Alarm System, Wired to Tiny Window and Door That Open and Close in Realistic Fashion. He Seeks Weak Spots That May Have Been Overlooked in the Signal Apparatus, Giving Burglars a Chance to Cut through Walls and Safes as They Did in Vault Door Above, Where Hole Large Enough for a Big Policeman to Crawl Through Was Made by Skilled Cracksmen with Acetylene Torches. At Left Is Portable Strong Box Containing Burglar Alarm That Rings Should an Attempt Be Made to Snatch the Chest from a Messenger in the Street

Left, Bullet-Proof Shelter on Wheels, with Bullet-Proof Glass Window, Protects Police Rifleman

© U. & U.

Police Wireless Operator, Above, Keeps in Touch with Flying Squads in Radio-Equipped Cars As They Cruise City or Spread Cordon about an Entire Section to Close All Roads to Fleeing Band of Bandits

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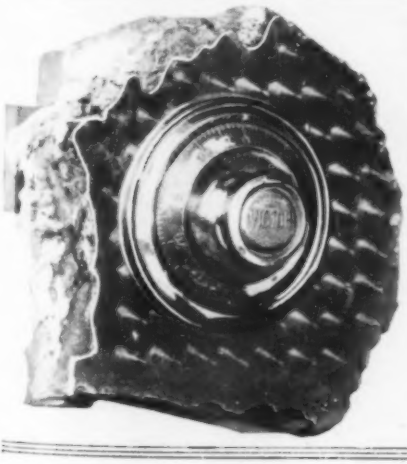
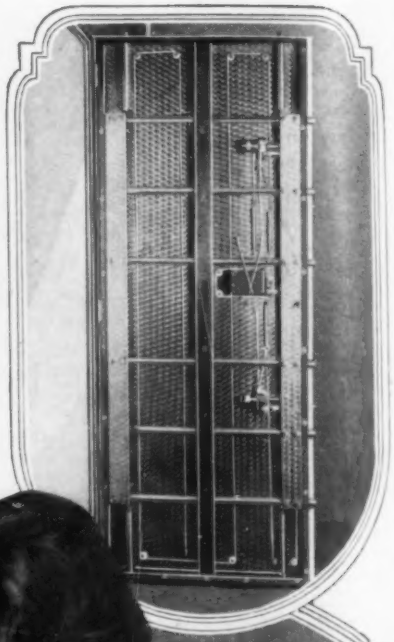
Combination Knob and Box of Five-Inch Safe Door after Yeggs Equipped with Acetylene Torch Burned it Out of Door to Release Bolt Action So Turn of the Handle Would Open Way to Contents of Supposedly Burglar-Proof Chest

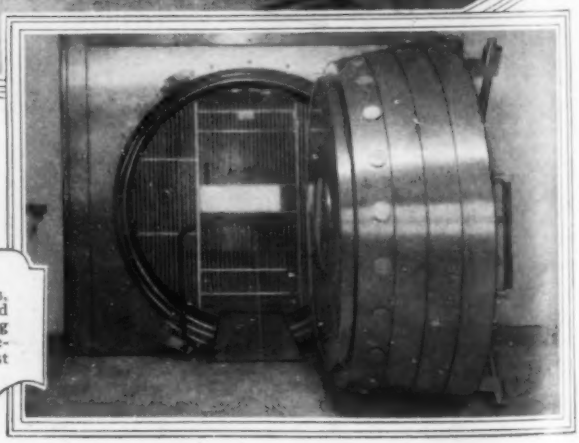


There Is No Explosion to Awake the Neighbors When a Modern Bank Bandit Burns His Way into a Vault with His Noiseless Oxyacetylene Equipment



Automatic Telegraph Printers Connect Police Stations to Flash Details of Crimes; Right, Inside of Vault Door Wired for Burglar-Proof Locks and Tear Gas

The Fingerprint Expert in a Few Minutes Can Find Any Wanted Print among Her Thousands of Records, While New Process of Sending Pictures by Wire Spreads It over Country



Massive Circular Vault Doors, Studded with Huge Bolts and Armored with Fire-Resisting Steel, Offer an Obstacle Designed to Discourage the Best Cracksmen

Motorcycle Policemen Capturing Bandits Who Have Been Forced to Flee from Their Car by the Explosion of a Tear-Gas Grenade Tossed by One of the Pursuers

the largest made up to that time, but five years later the New York federal reserve vaults' doors were made just twice as thick—ten feet of the hardest steel known.

For a long time it was believed that the ball type of manganese safe was impregnable. It was drill-proof, and its peculiar type of door construction offered no chance to pour in liquid explosive, while the offset combination locks resisted the sledge-hammer cracksman who knocks off the dial and punches out the tumblers with a steel rod.

Then came the development of the portable gas torch and the fluxing rod. The rod is just a bar of soft steel. Held with its point against the hard steel, just where the flame is applied, this rod oxidizes with tremendous rapidity and an irresistible temperature is developed. Even then the makers of the round chest believed it was safe, because, they said, any attempt to burn through it would be useless, as the heat would destroy the contents, and so give the burglar nothing for his pains. But a clever gang of robbers melted a tiny hole through the three-inch wall of a safe, and then inserted a funnel and filled the inside with water. Then they burned out a plug, leaving a hole big enough to insert the arm, and fished up the contents through the water.

Now bankers are wheeling their manganese safes into a vault equipped with tear gas. The inside of the door is a maze of steel wires, running over small brass pulleys and held at tension by strong springs. The wires cross every section of the door, and even crisscross over the combination box, to guard against any attempt to knock off the dial and punch out the tumblers. If the wire is broken at any place, the tension is released, two burglar-proof bolts shoot home, and one of them trips a trigger, which releases a spring-driven plunger in the tear-gas container, breaking the glass vials and releasing dense clouds of the unbearable gases.

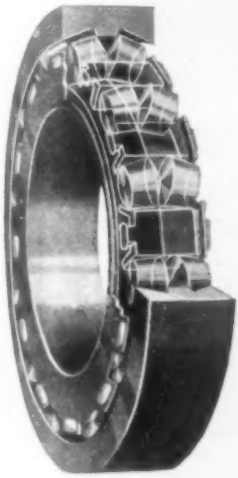
The introduction of gas is only one of the many changes made in modern vaults. Doors in the bigger vaults are no longer made with stepped or tongue-and-grooved edges. Instead they are plain cones, which plug the opening like the stopper of a bottle. Tests revealed that explosives poured into the cracks of a stepped door would exert tremendous leverage against the sides of the steps, forcing the door out, while with the plain cone type, the blast can only blow out into the room or into the vault, without tearing off the door. While new burglar-proof locks, tear-gas bombs and special construction are being extended to protect from burglars, bankers still put much of their trust in electrical alarm systems, and some of the latest models are so complete as to be virtually proof against any sort of attack. The electrical alarms, like those used on stores and residences, are divided into two classes, local alarms with gongs on the building to attract passers-by and police, and central-office alarms, in which a silent signal is flashed to headquarters of the burglar-protection company, which dispatches armed guards to the scene.

The End of the Road at the Old Cell House at Sing Sing

Toadstones Once in Big Demand for Use as Talismans

Certain black pebbles, known as toadstones, which toads were reputed to carry in their heads, though of little beauty as ornaments, were highly esteemed during the dark ages because of their alleged power to heal various kinds of digestive disorders and for their supposed protective influence over children. The wearer of one was thought immune from toothache; they were held as antidotes for poisons and believed to warn of the approach of a venomous reptile by imparting a stinging sensation to the flesh.

Twin Roller Bearings Absorb Shocks and Reduce Amount of Friction



Roller bearings in conical-shaped twin units to absorb shocks and reduce breakage and friction under heavy strains, such as in railroad-car service and similar uses, have been produced. It is claimed that the additional contacts they afford take up jars, prevent slipping and consequently cause less wear. They are interchangeable with standard roller bearings, are not difficult to install and are said to reduce maintenance costs considerably.

No Eggs Boiled on the Planet Mars Temperature Tests Prove

Owing to the rare state of air on the planet Mars, it has been shown by a government scientist, water there will boil at a much lower temperature than on the earth. To determine the degree of warmth of the distant sphere, the experimenter directs a ray of the planet's light upon two thin wires, thus setting up an electric current which is measured by delicate instruments. The temperature of Mars, according to the scientist, is from twenty to forty degrees cooler than that of the earth. This would make it impossible to boil eggs on the planet.

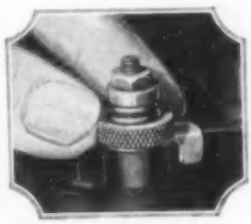
Worn Like Nose Glasses, the Novel Eyeshades Fit Close to Lids and Lashes

Eyeshades Serve as Extra Lashes to Shield against Sand and Sun

Fitting snugly into the eye sockets and just over the lids, light celluloid eyeshades of novel design have been placed on the market. Less cumbersome than the larger kinds, they are said to afford ample protection against bright sunshine on the beach and elsewhere, and also from dust and sand. They are manufactured in a variety of colors and do not interfere with the vision.

Auto Valve Adjusters Save "Gas" and Keep Motor Quiet

To keep valves in gasoline engines at the proper clearance, regulating notched dials that can be quickly attached without the help of tools or much work, have been invented. As the valves wear down, a turn of the adjuster with the thumb and finger quickly tightens them and secures the proper clearance, eight-thousandths of an inch, by means of carefully measured notches at the side. The attachments are said to eliminate the noise and rattle of loose valve tappets and make the motor run more smoothly.



Railways in the United States use 87,500,000 new ties every year.

Designer of the "Family" Dolls and Assistant Painting the Faces and Attaching the Arms After Bodies Have Come from the Lathe; Typical Costumes Are Seen at Right

Fireproof Paint Preserves Building Enveloped by Flames

Covered with paint containing a solution said to make oils fireproof, a building erected for a test by flames failed to burn after straw and kerosene were scattered over it and lighted. A similar structure to which the mixture was not applied was totally consumed within a few minutes after the blaze enveloped it. It is claimed that the chemical can be used to make rugs, laces and other cloth fabrics fireproof without injuring the materials or changing their appearance in any way.

Leaving Building Painted with Fireproof Solution After Unsuccessful Attempts Were Made to Burn It

Teaching of Children Is Made Easy by Groups of Dolls

Instructing young children through their play has long been one of the most successful teaching methods. This principle is now being applied effectively in sets of small wooden dolls originated by a former teacher and already adopted by the schools of several western cities for their kindergarten and primary departments. Realizing a child's fondness for "playing house," the creator of the toys has made the dolls in "family" units, one representing the professional man and his household and others the business man, the farmer and the Indian and their families. Provided with these four groups, the child has a natural incentive to dress them according to their station in society and work out, with pasteboard and magazine cut-outs, the proper environment for each. The dolls are turned from wood and consist of a head, body and base with attached arms. The "parent" dolls are each five inches high and the "children" one inch shorter. Faces and hair are painted on with durable enamel, and the matter of dress is left entirely to the ingenuity of the children.

¶Church bells made of an alloy of aluminum and copper, weighing about one-third as much as those of the usual bronze, are being used in a village near Cologne.

Sixty Thousand Pieces in Table Only Thirty Inches High

Consisting of 69,260 pieces of hardwood of 400 different kinds gathered from all parts of the world, an elaborately inlaid library table has been completed by an Ohio cabinetmaker, who spent approximately 3,000 hours on the task. It is only thirty inches high and the top is forty-two by twenty-eight inches. The largest piece of wood used was only three-quarters of an inch square and the smallest three-sixteenths of an inch. By careful matching of the woods, many unusual color combinations were obtained.

Pocket Microscope Has Strong Lens to Reveal Minute Objects

Folding into a case so small that it may be carried in the vest pocket, a microscope has been made for scientists, students, doctors, prospectors and others who cannot conveniently carry the heavy standard instrument on trips. The lens is strong

High-Powered Folding Microscope Extended and Being Put in Pocket in Carrying Case

enough for examining minute cell structures and for making blood counts. The instrument is equipped with a reflecting mirror, tube of standard length, invisible objective and other parts common to the laboratory device. Case and body are made of metal and special fittings shield the lens from dust.

Date Book in Department Store Aids Keeping Appointments

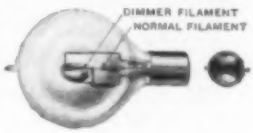
In a San Francisco department store is a public date book for the purpose of

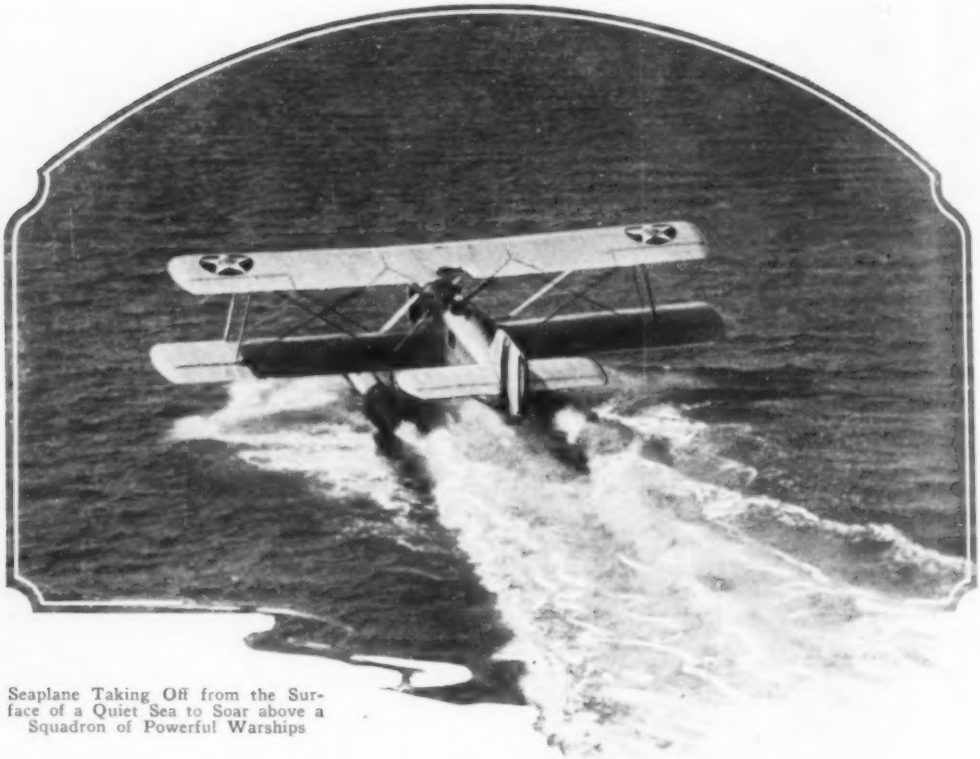
Telling the Date Book Where Friends Who Missed an Appointment May Find Her

relieving persons of suspense and worry, and preventing waste of time in waiting for friends. In case an appointment is not kept at the specified hour, the one who has arrived may leave a message for his companion, who has but to look at the book to tell where they may meet. Other messages may be written and the book serves as a convenient "silent secretary" for the public.

Anti-Dazzle Light Bulb for Auto Has Two Filaments

Blinding glare from automobile headlights is said to be practically eliminated by using bulbs with two filaments, one giving the normal driving light and the other shaded by an ingeniously arranged metal cap to cut off the upward rays that dazzle oncoming drivers. A switch brings the shaded filament into operation at the approach of another car. The cap projects the light to the top of the reflector, resulting in a downward illumination amply sufficient for the driver. The normal beam from the other filament is said to provide plenty of side light. The bulb can be adjusted and focused to almost any headlamp with little alterations in wiring.





Seaplane Taking Off from the Surface of a Quiet Sea to Soar above a Squadron of Powerful Warships

With the New Mosquito Fleet

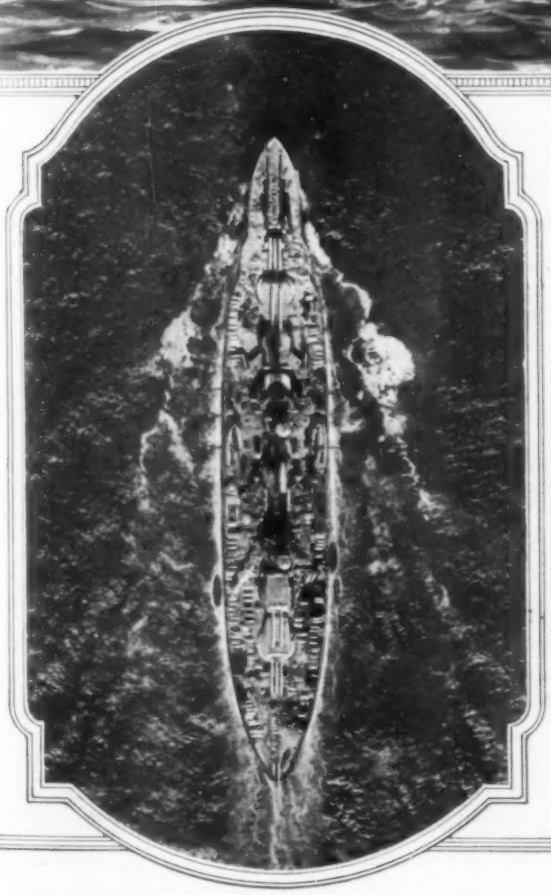
Armed Aircraft Developed as Aids to Fleets of Big Battleships It Was Believed They Might Render Obsolete

ONCE believed by many to be a weapon of warfare that would render big battleships obsolete, because of its ability to cover wide ranges at great speed while delivering destructive blows upon enemy positions and fleets, the airplane has been developed as an a most indispensable aid to naval units engaged in tactical maneuvering and long-distance firing.

Although the United States navy has made considerable progress in developing aerial mosquito fleets for bombing and torpedo attack, and to lay down effective smoke screens as an impediment to enemy offense, much attention has been paid to their value for scouting over the seas and as an aid to directing the fire of gunners who may be out of sight of the targets. Due to the tremendous range of the larger naval guns much of the firing is directed at points not visible from any part of the attacking vessels. Equipped with radio-sending apparatus, the airplane can take up an advantageous position several thousands of feet in the air, and from such point observe the effect of the shells, communicating valuable information to the fire-control quarters.

In addition to spotting the fall of the projectiles, the airmen observe and report all changes in the course and speed of moving enemy ships. For this purpose special instruments are employed to calculate the time consumed for such maneuvers. On board the attacking craft, the range and elevation of the rifles are adjusted to conform with these data.

To combat the watchfulness of the aerial observers and scouts, opposing aircraft are set against them. To repel these, battle squadrons are launched in flight, which practice may result in spectacular conflicts in future wars far above the scenes of the principal engagements, mak-



Launching a Deadly Torpedo from a Low-Flying Seaplane, Which Sends the Destructive Missile Speeding over the Sea to Explode against Hostile War Vessel Lying Helpless before the Onslaughts of the Swift, Darting Ships of the Air That Strike and Then Soar Thousands of Feet above the Scene to Watch the Effects of Their Work

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A Tempting Target for the Air Warrior's Aim; Aerial View of a Giant Warship under Full Speed but Which Is Not Fleet Enough to Foil the Swarm of Powerful Bombs That Pursuing Birdmen Might Send Crashing into the Huge Hulk; Smoke Screens Are Designed to Obscure Such Vessels from the Watchful Eyes of Enemy Observers

ing it necessary for large numbers of air machines to accompany the war vessels under battle conditions. For some time planes have been carried aboard the battleships, from which they take flight by means of catapulting devices that project them at great speed into the wind. Once clear of the decks, the fliers' engines take up the task of propelling the planes. When returning to the parent vessel, the seaplanes land close by on the water and are raised to their resting places on the decks by hoists. Aircraft-carrier ships are now being added to the naval fleets for the purpose of accompanying them to sea with suitable forces of flying machines. The carriers, besides providing quarters for the seaplanes, furnish them with repairs, fuel and replacement parts. Storage rooms are built in the hulls of the mother ships to accommodate unassembled machines which can be set up on short notice when needed. Quarters are also provided for the flying crews. The upper deck of the carrier offers both an unobstructed landing field for the seaplanes and a take-off runway, doing away with water landings.

Large supplies of aerial bombs and torpedoes and chemical materials for creating the dense smoke screens may be distributed to the planes from the carriers. Frequently an airplane fleet may be called upon to protect both its own units and the naval armada from the enemy by means of the vapor curtains. In case the battleships are outnumbered and forced to withdraw speedily from the vicinity of enemy forces the screens might be employed to confuse the opposing observers, enabling the movement to be made with little or no loss to the retreating craft. The chemicals used to lay down an aerial smoke curtain, cause a dense foglike cloud to streak out behind the airplane which, being heavier than air, descends to the ocean surface in a vaporous wall practically impenetrable to the eye.

In making an aerial-bomb or torpedo raid, the purpose of the air force is to so confuse the commanders that their attention is diverted from the line of warships confronting them and to cause them to break their battle formation, thus weakening their position when actual hostilities begin. Increase in weight and power of aerial projectiles has made this form of air fighting of great worth, and efficiency in launching the missiles fairly effectively on moving targets has placed the air units in the class of capital weapons.

While it is possible to sink ships as a result of aerial attacks, the ability of the target to move freely about in any direction lessens the number of hits and might avoid serious damage even were a vessel struck by a descending charge, but where enemy seacraft are forced to dodge about on the water, the movements generally cause a break in their line formation.

Mosquito Fleet of Naval Aircraft Preparing to Rise in Battle Formation during Practice Drill in Use of Aerial Bombs against a Series of Floating Targets

What the Big Battleship Guns Did to the Target at Range of Several Miles; Sailors Inspecting the Hits and Repairing Slats for Further Shooting

Phantom Ships Aid Naval Gunners to Perfect Marksmanship

Convincing proof of the accuracy of gunfire during maneuvers of the Pacific fleet was seen in the shattered latticework of the huge floating targets placed several miles from the firing line. About the height of a warship's side, the framework of one of the marks was found pierced several times in the center, while some shots penetrated at what would have been approximately the waterline of a real vessel. After the practice, sailors were dispatched to make exact reports of the locations of the hits and repair the slats for further shooting. Broad strips of canvas, stretched lengthwise and across the target, made it visible at great distances and increased the resemblance to an actual ship. As it bobs lightly about with almost every movement of the water, the utmost precision in aiming is necessary in order to score a direct hit.

Mesh Bags Are Woven from Wire by an Automatic Machine

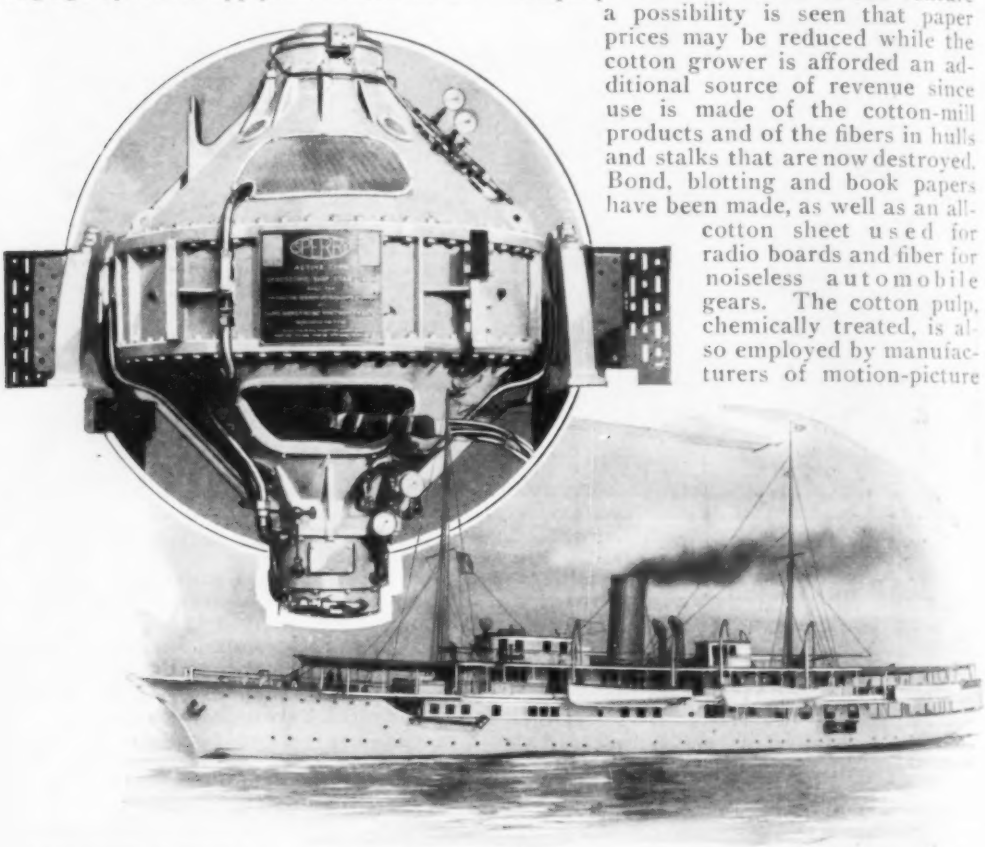
After cutting rings from wire fed to it by reels, a machine that weaves mesh bags, links and solders the tiny loops at the rate of 400 a minute. Various colored metals may be used and worked into artistic patterns, such as are found in cloth fabrics, with slight adjustments to the mechanism. Because of a core of soldering metal running through the wire, it is said the device can attain great speeds in joining the rings.

Weaving Wire Mesh Bags on Machine That Makes and Solders 400 Tiny Rings a Minute

With some sizes of mesh, the rings can be made at a rate of 700 a minute.

Yacht Is Held Steady as a Liner by Twelve-Ton Stabilizer

Seasickness is said to be next to impossible on the 250-foot yacht, completed not long ago by the Krupp plant at Kiel for an American millionaire, due to the fact that it is steadied at all times on voyages by a twelve-ton gyroscope. This instrument, which has been in use for some time on ocean liners, is said to prevent the yacht rolling more than three degrees so that persons on board are not compelled to undergo the nervous strain of constantly seeking to maintain their balance, one of the chief causes of seasickness. The stabilizer consists principally of a heavy wheel, revolved at high speed by electricity and suspended in such a way that its motion keeps the ship from tipping to either side even in stormy weather.



Yacht "Vanadis" and the Twelve-Ton Stabilizer of the Type Used on Ocean Liners to Keep Vessel from Rolling and Rocking on Voyages at Sea

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¶Parasites usually form the nucleus of pearls about which several delicate layers of material are deposited.

Paper Made from Cotton Products Points New Use for Crop

Paper of various grades is being manufactured from cotton by a Tennessee company. In the success of the venture a possibility is seen that paper prices may be reduced while the cotton grower is afforded an additional source of revenue since use is made of the cotton-mill products and of the fibers in hulls and stalks that are now destroyed. Bond, blotting and book papers have been made, as well as an all-cotton sheet used for radio boards and fiber for noiseless automobile gears. The cotton pulp, chemically treated, is also employed by manufacturers of motion-picture films, artificial leather and silk and celluloid, and demand for it will be greatly stimulated, it is said, if the cotton paper becomes widely used.

Wax Produced by Insects on Trees Used for Candles in China

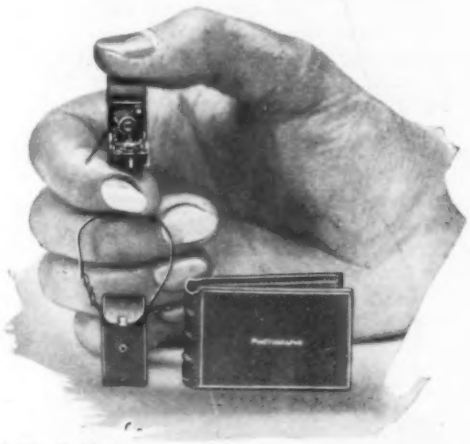
In some of the inland provinces of China, the only light the natives have when darkness falls is that shed by crude candles made from wax secreted by tiny insects which attach themselves to the boughs of evergreen trees. In a day or so, they begin the formation of a white, waxy substance. This is scraped off, melted and passed through strainers to remove impurities and is finally made into candles.

Autos Cost More than Furniture, Government Figures Show

That the automobile industry in America has grown to such tremendous proportions that the country now spends over a billion dollars a year more on cars than for house furniture, and more in salaries to chauffeurs and garage mechanics than to public-school teachers, is shown by government statistics. Other figures disclose that the United States spends over $500,000,000 a year for candy and ice cream, and that the value of the pearls in New York city alone is placed at $700,000,000.

Tiny Camera Is Built under Lens with Jewelers' Tools

Requiring the use of jewelers' tools and magnifying glasses in its construction, a miniature camera with parts that work, and less than an inch in length, has been made for the royal doll house of the queen of England. Three months' continuous work by experts was necessary to complete the tiny instrument. All pieces were formed by hand and carefully checked with larger cameras to insure accurate shape. The lens is a minute disk of crystal, and the shutter may be operated the same as in the real article. A small pencil for autographing is provided in a holder on the back. The bellows can be



Courtesy Kodak, Ltd.

Pygmy Camera Outfit, Part of Furnishings of Queen of England's Royal Doll Palace

easily opened out and folded for inserting the camera in a carrying case which has been furnished to fit it. An album, neatly bound and decorated, is also a part of the pygmy photographic outfit.

Realistic Figurehead of Woman in Fashions of Early '50's, Adorning Prow of Clipper Ship

Figurehead on Clipper Ship Recalls Old Romance of the Seas

In the days before the advent of the steamer, when "ships were wood and men were iron," as old sailors like to say, one of the picturesque and romantic features of the famous American clippers and other craft of their type was the ornate figureheads that adorned their prows. Elaborately carved, these designs sometimes represented such allegorical conceptions as the "Spirit of the Sea" or the "Queen of the Winds," while others were lifelike representations of the sponsor of the vessel or the wives, daughters or sweethearts of the owners or captains. One of the few clippers still in service carries at her bow the figure of a woman quaintly dressed in the style of seventy years ago. Politics also entered into the custom to some extent for the "Constitution," or "Old Ironsides," carried as her figurehead a statue of President Jackson. One night in port the figure was beheaded by some person who believed that the statue was inappropriate for naval uses. It was repaired and now stands in the grounds of the naval academy at Annapolis.

¶In one section of a Brazilian railroad, which is said to be the best-paying line in the world, there is a drop of 2,600 feet in seven miles.

Paper Hat Parasol for Men Serves as Shield from Sun or Rain

Protection from sun or rain is provided by a paper parasol that slips over the top of men's hats and is held by a rubber band

Hat Parasol in Place with Ribbed Edge Extending Well over Wearer s Shoulders

or piece of elastic. The flaps that hang over the brim can be folded in nine different ways, thus shielding the wearer at any desired angle while the exposed portions of the shade may be printed with advertisements. Special styles are manufactured also in thin sheet rubber with rigid side strips, while those made from ordinary paper or with cheesecloth backing have been found serviceable even in heavy rains. When not in use, the parasol can be folded up and placed in the pocket.

Watches Are Broken Up by Uncle Sam to Test Skill of Makers

Besides testing all kinds of timepieces, freezing them in refrigerators and baking them in ovens, Uncle Sam takes watches apart and breaks them so that they may be repaired by applicants for watchmakers' certificates. Many watches contain more than 200 pieces, about one-third of which are screws, some of them so small that 20,000 of them will go in a thimble. The man who can mend and reassemble all these delicate parts and make them run accurately, the government considers, has amply proved his skill and he is awarded a diploma. Good timepieces are expected to run accurately regardless of the season and weather. One way the government tests a watch is to run it for twenty-four hours in an oven heated to eighty-four degrees and then place it on ice for the same length of time. A gain of three seconds at one temperature and a loss of five at another is considered a total error of eight. This is corrected, if possible, by the man who "rates" the watch by moving the little screws in the balance wheel to different holes in the two sides of the rim. Notation of the change is made and the tests repeated until the watch runs the same in the oven and on the ice.

Rattling Toy That Shoots Sparks Adds to Fun at Celebrations

Showers of brilliant sparks and a loud rattling noise are made simultaneously with a novel toy designed for children, or even grown-ups when they celebrate various occasions. It consists of a short bar or hollow sound chamber, at one end of which is a ratchet device and a disk of a metal preparation which sends off sparks when it is turned under a spring clamp. To operate it, a short handle just below the disk is grasped and the toy swung clockwise. The movement turns the disk and causes the ratchet to snap. The metal pieces may be renewed when the sparks grow dim. A similar device without the noise-making attachment is provided in a

When Whirled Around, This Toy Shoots Showers of Sparks and Makes a Loud Noise

sparker wheel rotated rapidly by pulling a string that rewinds automatically within a hollow grip.

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Weighing Part of a Large Consignment of Imported Gold Bullion; the Massive Scales Are Delicately Adjusted So That There Is Slight Chance for Error in the Heavy Balances

World's Gold Flowing to America

Coins from Foreign Governments "Naturalized" in Melting Pot to Fit Them for Minting into American Money

WITH gold from foreign countries flowing into United States money vaults at the rate of $37,000,000 a month, the entire output of the world's mines for the first half of 1924 was absorbed. At present the stock of the yellow metal held in this country is a little over $4,000,000,000, a sum which requires almost $200,000,000 additional each year to keep prices stabilized and to meet the financial needs of growing industries. Since not more than $50,000,000 worth of gold is annually produced in the mines of this nation, the difference must be imported.

Interest on loans to European governments and payments of war debts form a great part of the stream of precious metal that pours into the coffers of Uncle Sam's money houses, while commercial exchanges help to swell the supplies coming from those nations where large markets consume immense stocks of American goods. All gold entering the country in the form of money must pass the "naturalization" process of the assay offices, as most of the other governments employ alloys in their coins of different standards from those contained in metal currency of the United States. The consignments are unloaded from the steamships under heavy guard, while a crew of workmen pile the boxes or sacks onto handtrucks on which they are conveyed to waiting vehicles and rushed to the assayers. All packages are carefully opened and the contents weighed on gigantic scales, delicately adjusted and as accurate as chemists' balances.

Great melting pots reduce the metal to a molten state in preparation for the processes of separation of the alloys before the gold is permitted to pass into the

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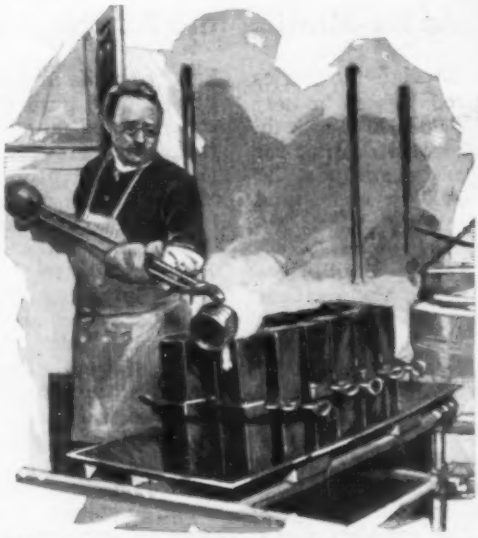
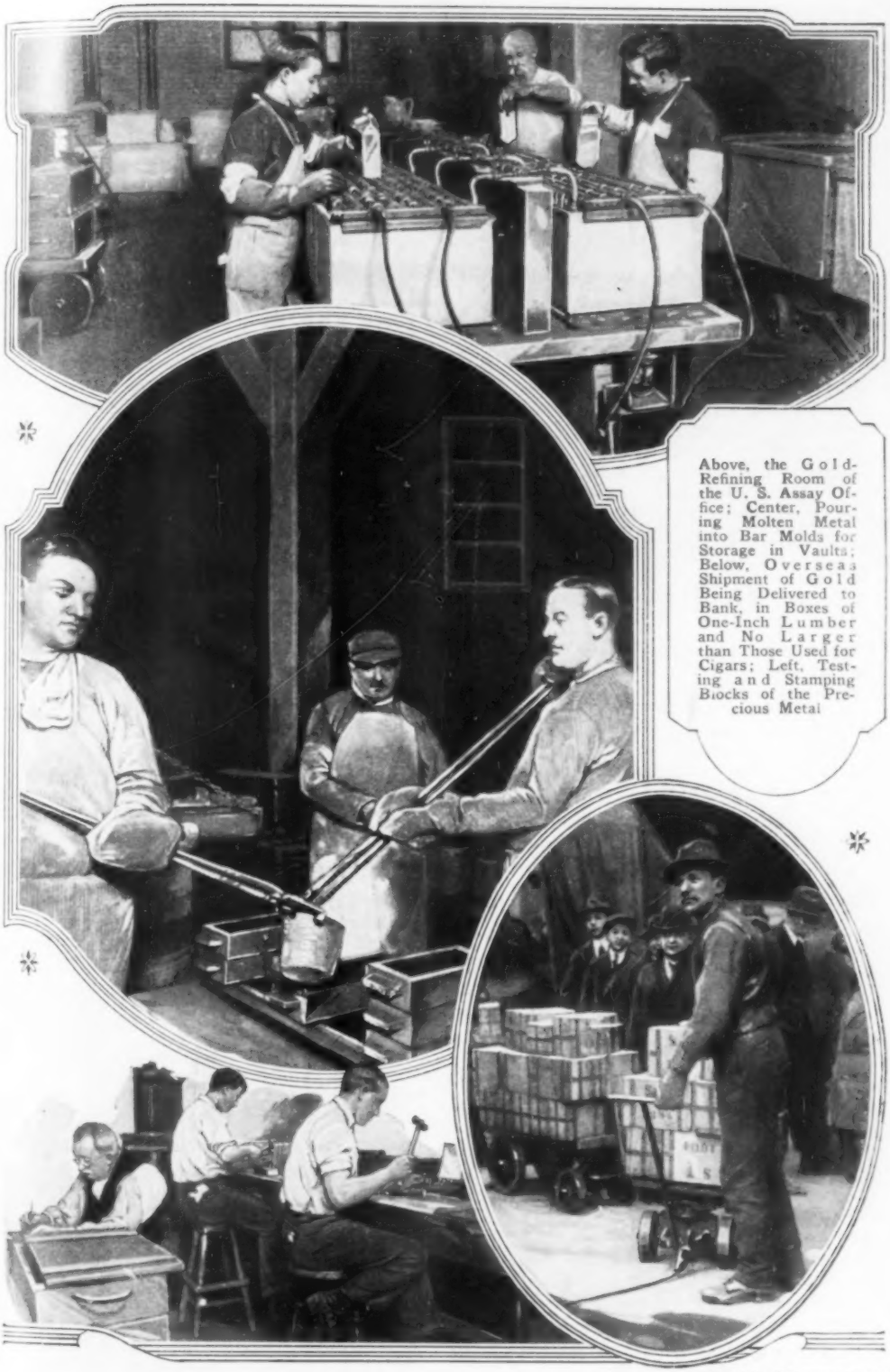
One of the Huge Melting Pots in the Assay Office Where Foreign Coins Are "Naturalized" for American Mints by Extracting the Various Alloys from the Metals

hands of the mints. Piled in heaps, the coins are shoveled with large coal scoops into the smelters, where they become a semiliquid mass. Chemicals and electric treatment are then applied to divide the pure gold from the mixtures of other metals. Alloy standards of France and England being about the same as that of the United States mints, coins from those two countries can be naturalized or reminted with little difficulty. These are loaded in the pots, and when melted down, are poured into molds, a row at a time. As each layer of the casting boxes is filled up, powdered charcoal is scattered over the metal and another tier of molds is placed on top, this process being repeated until a "wall" of gold bricks remains to cool. After hardening, the bars are removed from the holders and subjected to examination during which they are weighed and stamped for shipment to the mint or storage in subtreasury vaults, piled up like cordwood.

During inspection each block is carefully tested for purity by experts who certify it by stamping the letters "U. S." on the surface. Sometimes pure bullion is sent from the foreign countries in heavy bars, carefully inclosed in strong boxes. Most of the shipping containers for such consignments as well as for coins are made of one-inch lumber, but the holder itself is about the size of a cigar box. When filled, the packages require two men to lift and carry them to the trucks. The greatest gold-producing area of the world is South Africa from where the larger part of



Casting Large Ingots of Gold in Molds for Storage in the Treasury Vaults



Above, the Gold-Refining Room of the U. S. Assay Office; Center, Pouring Molten Metal into Bar Molds for Storage in Vaults; Below, Overseas Shipment of Gold Being Delivered to Bank, in Boxes of One-Inch Lumber and No Larger than Those Used for Cigars; Left, Testing and Stamping Blocks of the Precious Metal

Copyright, Keystone View Co.

the new metal for minting and that used to reinforce the treasury holdings is purchased. Many of the big ocean liners carry millions of dollars worth of gold on every trip.

Gold consigned from foreign points to banks in this country goes immediately to the United States assaying office and experts determine its value to a penny before it is accepted by financial concerns. A large force of assayers is always kept busy in the weighing rooms, for the receipts of gold are practically always so far in advance of the consignments sent abroad that there is seldom a quiet season, except during the tourist periods. And although these travelers leave a sum estimated at $400,000,000 scattered among the cities of Europe and the Orient, it does not affect the balance of gold trade.

Bureau of Engraving at Washington, Where Uncle Sam Prints the Crisp New Green and Yellow Bills That Save Handling of Stacks of Gold and Silver Coins

Egg Cups Carved from Bits of Coal with Pocket Knife and File

Working with a pocket knife and a file, an English wood-carving expert has attracted considerable attention with his polished egg cups and various ornaments which he cuts from pieces of hard-grained coal. In appearance, they resemble those of jet and are given added beauty by the markings which compare with the grain in costly woods. The maker is said to have spent fifty hours in fashioning the cups shown in the illustration and refused various prices up to $200 offered by curio collectors for the unique objects.

Copyright, D. H. Holden

Finished Cups, a Chunk of Coal and Simple Tools the Expert Carver Uses

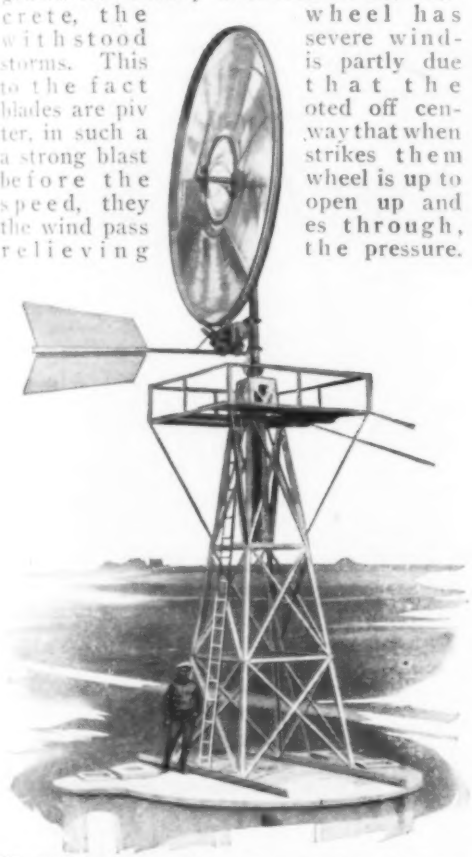
Chemist Makes Sugar as Plants Do from Carbon, Water and Light

What is declared to be "one of the greatest triumphs of modern times," is reported to have been achieved by Dr. E. C. C. Baly of the University of Liverpool, Eng., in making sugar in a way similar to that in which plants produce it. The process consists in exposing carbon monoxide and

water to ultraviolet rays from a mercury-vapor lamp in such a way that formaldehyde, which immediately turns into sugar, is formed.

Windmill Built upon Silo Generates Power and Light for Farm

Mounted upon a short steel tower on top of a fifty-five foot silo, a specially designed windmill owned by a Minnesota farmer generates sufficient electricity for lighting his house and barn and for running some of the farm implements and household appliances, such as the washing machine, churn and vacuum cleaner. The current is stored in a large battery in the basement of the house and the main switchboard is conveniently placed in the kitchen. The top of the wheel is eighty-feet above ground where it catches almost every breath of wind, and just below is a platform, eight feet square, for use in oiling and in inspecting or repairing the generator. Firmly anchored to the concrete, the wheel has withstood severe windstorms. This is partly due to the fact that the blades are pivoted off center, in such a way that when a strong blast strikes them before the wheel is up to speed, they open up and the wind passes through, relieving the pressure.



Windmill Power and Light Plant for Farm in Operation on Top of Silo

White-Rooster Emblem Town Erected near Railway Station to Advertise Its Poultry Business

Fifteen-Foot Statue of Rooster Built as Emblem by Town

Announcing that it boasts the honor of being the greatest poultry-raising center in the world a California town has erected a gigantic replica of a white rooster at its railway station. The figure, with its stand, is fifteen feet high and is mounted on a wooden pedestal with a picket fence surrounding it. Plainly visible to passengers passing through, the emblem is proving a striking and effective advertiser for the town and its enterprise.

Music Twenty-Seven Centuries Old Written on Earthen Tablet

Babylonian music, believed to have been composed about the year 800 B.C. and possibly belonging to a period much earlier, has been deciphered from an ancient earthen tablet by Dr. Kurt Sachs of the Berlin high school, according to reports. The notes are said to have many of the characteristics of the Chinese music of today and evidently were arranged for a harp of twenty-two strings. The tablet, about the size of five ordinary bricks, was unearthed on the site of Assur, the ancient Assyrian capital, and has been in a museum for some time. The inscription is arranged in three columns, the first of which long had baffled scientists until it was discovered that the odd characters represented a musical system.

Single-Wheeled Motorcycle Carries Rider on Inside of Rim

A single-wheeled, spokeless motorcycle has been invented in Italy. Engine and seat are held on a frame within a large outer revolving tire which passes over pulleys. Power is applied directly to the outside rim, the single wheel affording the traction and carrying the load. The rider's feet are close to the ground so that he can easily regain his balance in case the vehicle should tip. It is guided by a regulation steering wheel.

Inventor Testing Single-Wheeled Motorcycle That Carries Rider and Engine on the Rim

Greater Speed in Cable Messages Is Promised by New Line

The speed of transmission of transoceanic messages is expected to be increased from five to eight times with the laying of a new type of submarine cable which is to connect New York directly with Italy for the first time. Since Cyrus Field linked the continents in 1858, considerable speed has been gained in transmission of messages by improvements in sending and receiving apparatus, but there have been few changes in the cable. Lately, experts have found that the "loading" system used in telephone communication is suitable to lines laid under the sea and have therefore devised a cable about an inch in diameter, which has a metal ribbon, consisting of eighty per cent nickel and twenty per cent iron, the most highly magnetic preparation yet discovered, wound in a spiral about the central copper core. This ribbon, it is said, eliminates the "overlapping" of impulses commonly encountered on the present types of cable.

Fog-Piercing Ray to Guide Fliers

For some time the British air ministry has been experimenting with fog-penetrating searchlights that project a ray of deep-red tint to overcome some of the hazards of aviation and navigation. The red, it has been found, travels through fog far more readily than blue or violet light, just as mariners discovered that the old-fashioned oil lamp, in a dense haze, illuminated the surrounding area better than electric lights of many times the candlepower. This is believed partly due to the longer wave length of the red and yellow lights. Tests with this ray are being watched with great interest both by fliers and sailors. At a high altitude, the aviator may be enjoying perfectly clear air but may suddenly find himself in an ever-thickening bank when his plane reaches the lower levels, while fogs are among the most common causes of collisions of ships and wrecks along rocky coasts and shoals.

Shields on Car Wheels Reduce Noise

Noise on cars in the London subways has been reduced to such a degree that a watch can be heard ticking ten inches from the ear while a train is running. This has been done partly by putting sound-absorbing materials on floors and roofs of the cars and partly by shielding one side of the wheels, thus deflecting the sound waves before they reach the passenger.

Metal Pottery Molded like Clay Needs No Burning or Glazing

Pottery manufactured from a patented composition is being put on the market in Germany. While the exact nature of the material is a trade secret, it is known to contain sand, sulphur and various metals combined in such a way that in making the articles, the mixture is simply poured into molds and allowed to dry. It needs no burning or glazing, it is said. Its natural color is a brownish-black, but other shades are obtained easily. Urns, vases, trays and cases for clocks are a few of the articles being made from the material.

Door Mats Woven of Old Auto Tires Are Durable and Won't Skid

Discarded automobile tires are put to practical use as durable door mats by a western manufacturer who has patented his product. The tire walls are cut into small, oblong links each of which is perforated at both ends and then connected by galvanized wire. Mats of various sizes and proportions are easily constructed. They are said to be quickly

Auto-Tire Mat Extended, and One of the Links

cleaned, comfortable to stand upon, and will not slip. They have been found useful in boats, industrial plants, elevators and restaurants and are said to be so resilient that dishes dropped upon them are not likely to break.

¶ Importation of cheese to America has trebled since 1920.

Hitched to Cart with Pony, Collies Are Safe from Autos and Help Pull

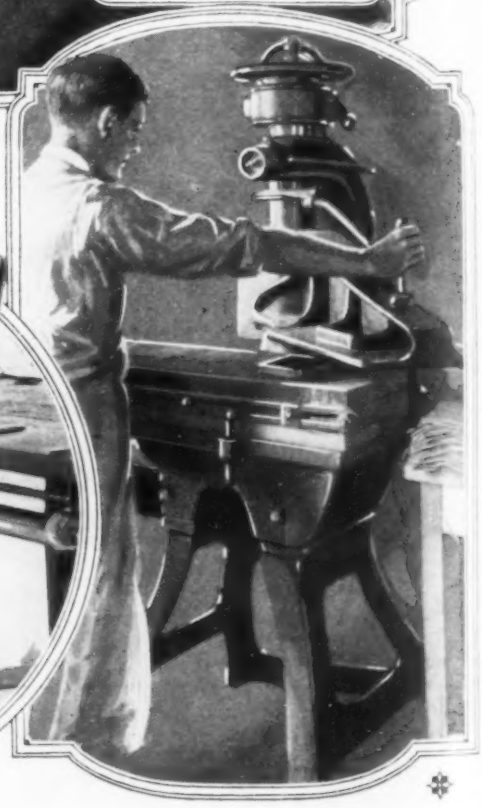
Collies Trained to Pull with Pony Help Give Cripple Airing

Fearing that his trusty collie dogs, which persisted in accompanying him when he went driving with his Shetland pony, would be maimed or killed by automobiles, a cripple in a western city finally hit upon the ingenious scheme of hitching the dogs to the rig with the pony. Each collie is tied to the shafts by a rope and helps pull the car by a small singletree and tugs. The three animals display splendid teamwork, their owner declares, and trotting along together, seem to enjoy giving their master an airing.

Spray for Cleaning and Painting Works at Touch of Trigger

Operated by a touch on a trigger placed conveniently in a pistol-like grip, a spray gun has been made for cleaning engines, transmission gears, rock drills and pneumatic drills of all kinds by means of compressed air in connection with kerosene or gasoline. It may be used also for applying wood preservatives, insecticides, creosote, paint or whitewash.

Inspecting and Matching Gloves in Pairs; Co'or, Weight and Appearance Must Be Identical Before They Are Passed to the Stock Room



Right, "Clicking" Machine That Cuts Cuffs and Linings; Below, "Laying Off" Gloves on Hot Metal Hands

Gloves That Graced Hands of Notables of Past Ages; Pair Once Owned by Queen Elizabeth, Style Worn by Bishop of Fourteenth Century and Embroidered Gauntlets Fashionable in 1600

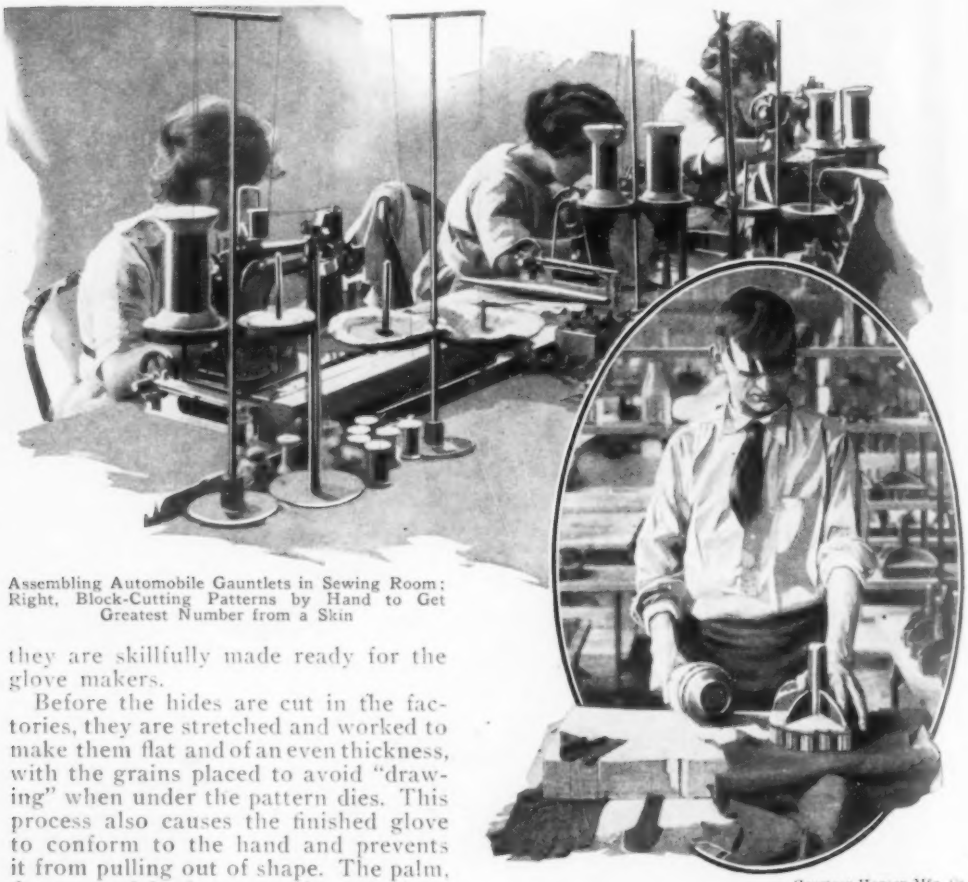
Tailoring Leather to Clothe Our Hands

Glove-Making Industry, Once Art of Ancients, Manufactures More than $70,000,000 Worth of Products Each Year in U. S.

GLOVES to the number of more than 115,000,000 pairs, enough to dress the hands of every person in the United States, are now consumed yearly by the people of this nation. Despite growing demands for the fancier article, less than 8,000,000 pairs are imported from abroad. The rest are produced by the glove factories of this country which annually manufacture an output estimated to be worth $70,000,000. Of the total product, about sixty-six per cent consist of men's leather work gloves, due to their growing use in the industries, by structural iron workers and in the making and driving of automobiles. However, the fashion of wearing gloves is said to be about equally divided between men and women.

Up to a few years ago, most of them were made of the more common leathers and the dress varieties from kidskin, a name employed to distinguish the h.des of deer, sheep, goats and calves. Now the skins of dog, cat, fox, bear, horse, kangaroo, hog, rat and many other animals are made into comfortable and attractive coverings for the hands. Many of the popular grades of gloves are formed entirely of cotton, silk, wool, and similar fabrics. Of the raw hides required for the leather product about seventy per cent, as well as most of the tanning materials, are imported. Various names are applied to the same skins subjected to different treatments in the tanning and dressing processes. The English "cape" glove is formed of the skins of sheep of South Africa. The velvetlike surface of the "suede" is achieved by buffing the natural grain of the skin against an emery-faced wooden wheel, while the pebbled finish is just the original surface highly polished. Horsehide or coltskin leathers are divided into two chief grades. The coat of the city-bred animal, because of the beast's better breed and careful grooming generally results in a hide superior to that of the country equine, where rough work, little care and exposure are likely to produce a coarse and scrubby skin.

From sheep raised near Mocha, in far-off Arabia, come the beautiful, strong leathers known by the name of that city. These animals are looked upon by the inhabitants of that territory as sacred and are permitted to be killed only during one month of the year. Those bred on the higher lands produce hides of much finer quality than the skins found on the sheep of the valleys. While numerous skins are received in this country already dressed by the tanners at foreign markets, many come almost raw, salted and dried with the hair or wool still on them. Put through the treatments that reduce them to smoothly finished sheets with soft, silky textures



Assembling Automobile Gauntlets in Sewing Room; Right, Block-Cutting Patterns by Hand to Get Greatest Number from a Skin

Courtesy Hansen Mfg. Co.

they are skillfully made ready for the glove makers.

Before the hides are cut in the factories, they are stretched and worked to make them flat and of an even thickness, with the grains placed to avoid "drawing" when under the pattern dies. This process also causes the finished glove to conform to the hand and prevents it from pulling out of shape. The palm, fingers and back are cut in one piece, from a section about an inch wider than that of the completed size. In finer grades of gloves more care is taken with the cutting than for ordinary varieties. From the trimmings left, the "forchettes" or sides of the fingers are fashioned, as are the "quirks," the diamond-shaped sections inserted at the bottoms of the fingers. All pieces are marked and wrapped together for the sewers.

After they are made, the gloves must be "laid off" on hollow metal forms of hands, heated with live steam. Here they are smoothed, stretched and patted into shape. On pressing boards, the fingers of automobile gloves are creased into the accordion folds down the sides, while the cuffs of gauntlets are all ironed by hand. Then the completed articles go to inspectors where they are matched for color, weight, and general appearance.

The adoption of the glove as an article of wear is thought to have been introduced ages ago through the custom of carrying a pet falcon on the wrist, as both a protection to the bird and its owner. Later worn by all classes, gloves were made of silk, soft leathers and worsteds, the wealthy and the nobility being distinguished by richly embroidered gauntlets that were often trimmed with lace. Discoveries made among ancient ruins point to the fact that gloves were known some time during the age of cave dwellers. Crude leather specimens have been found in long buried remains of that period, but these are about the size of a small ham, roughly held together with thongs. Although the ancient Greeks wore gloves, they were used more for the safety of the hands when engaged in manual labor than as a means of decorating the person. In Rome only those of high rank or members of the priesthood covered their hands.

France was once the home of glove-making, which was later introduced into Italy, England and Germany, but so great has been the growth of the industry in the United States that this country is rapidly becoming the world's center for the art.

Stretching and Working Leather to Make Grain Even and Reveal Undesirable Blemishes

Above, Polishing Gloves against a Whirling Buffing Wheel Made of Silk; Below, Turning Inseam Models Right Side Out

Spur-Clad Climber Walks Up Tree and Cuts Off Its Top

Climbing a hundred feet to the lower branches of a stately white-pine tree, sawing off the top, and then sliding back to the ground, all in eighteen minutes, gave W. H. (Slim) Hamilton the title of world's champion woodman at a celebration marking the opening of what is claimed to be the world's greatest sawmill, at Longview, Wash. With a stout rope fastened by one end to a heavy leather belt, while the other end is wrapped firmly about the wrist, and with a long "tiller-handled" saw dangling out of the way at the end of a light line, the spur-clad timber topper literally walks up the sides of the huge pines. When he reaches the lowest branches, often more than a hundred feet in the air, the lumberman fastens the free end of the rope to his belt, pulls up the saw, and leaning back with spikes braced, saws away with both hands. The job is one of the most dangerous in the lumber camps, for the severed top at the best can only narrowly miss the topper, and sometimes hits him, while he is helpless to dodge. By topping off the log before felling it, damage to near-by young trees from the thrashing top can be avoided.

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With Saw Dangling at Heel and One Hand on Rope, Tree-Topper Pauses in Perpendicular Walk for Downward Look from Dizzy Height

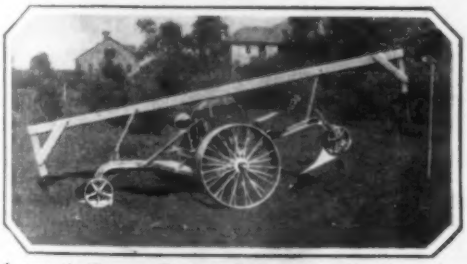
Fat Spark No Aid to Motorists

Tests by the bureau of standards apparently have shattered the cherished belief of motorists that a fat spark gives better ignition and more power than a lean one. The experiments were conducted under a variety of conditions, with all sizes of sparks and with the aid of a special motion-picture camera to record the results. The conclusions were that the shape of the electrode makes no difference so far as the explosion is concerned. One of the methods used was to place the gas mixture in soap bubbles and in glass tubes under pressure. These fragile containers were then fired with sparks generated in various ways. The camera showed that the gas nearest the spark was ignited first and that the flame spread in the form of a hollow globe, growing larger until it had used up all of the mixture. So far as the rapidity of the action was involved, the spark from the feeblest flivver coil was on a par with that from the most expensive magneto.

Manless Automatic Tractor Plow Reduces Farmer's Labors

To reduce the farmer's toil and cut the cost of plowing, now estimated at $150,000,000 a year for the entire country, an Iowa inventor has devised a manless automatic tractor plow. It is claimed that the only attention this unique implement requires after it is started, is to keep the gasoline tank replenished and to administer an occasional oiling. All the farmer

has to do is to plow an initial furrow. Properly set, the tractor will then travel back and forth across the field by itself, like a shuttle, spacing itself a furrow at a time at the end of each trip and following the original course accurately. The outfit consists of a two-wheeled tractor with a four-horsepower engine. Right and left plow bottoms are attached to the frame with their beams opposite and nearly at right angles to the tractor axle. They are so placed that when one share is in action, the other is carried above the surface of the soil. A reversing arm hangs over the tractor in such a way that when it comes in contact with a boundary fence, it is pushed back, actuating a spring. This reverses the drivers and, at the same time, the plow in service is lifted out of the soil and the other descends ready to enter the ground. To space the tractor the driving wheel on the plowed side makes part of a revolution while the driver on the unbroken side serves as a pivot, thus swinging the plow over for another "bite." If for any reason, the machine should leave



Automatic Tractor Plow in Action, Showing Reversing Beam and Suspended Share near Fence

the furrow and start across the field, a small wheel comes into contact with the ground, cutting off the ignition and stopping the motor. The inventor admits that it is necessary that the field be rectangular in shape and have fence barriers to operate the reversing arm. One of these plows has already been used successfully at the Iowa State College, at Ames. Since the tractor can be operated at night, it is considered an advantage, particularly if the plowing season is limited, and as it leaves the farmer free to attend to other tasks in the day, it practically doubles his labor supply.

One-Man Flivver Plane Flies One Hundred Miles an Hour

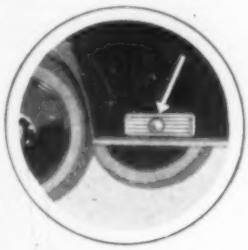
Weighing only 450 pounds and with a wing spread of eighteen feet, one of the smallest airplanes built for cross-country

Spry Flivver Plane, Built for Cross-Country Flight, Is Easily Tended by Pilot

flying has been completed at Kelly Field, Tex. On a flight to Dayton, Ohio, it attained a speed of 105 miles an hour, making twenty miles on a gallon of gasoline. The engine is designed on the same lines as that of a motorcycle and is specially geared for running the propeller. These small airplanes, some fliers assert, herald the approach of the day when the one-man flivver machine will be commonly used. Though a trifle more tricky than the larger ones, they are considered safe.

Night Driving Is Made Safer by Running-Board Lights

To decrease the dangers of night driving, red and green kick-plate lamp signals have been invented for the running boards of automobiles. They are inclosed in a wide, attractively designed aluminum casting which protects the side of the car when stepping in. The lights also provide illumination in parking, help protect the fenders and add to the appearance of the car. The bulbs are connected to the tail and headlight wires, no extra switch being required. Each is protected by fiber washers and the lenses magnify the light.



Moss Matting Made as Substitute for Linoleum and Cork

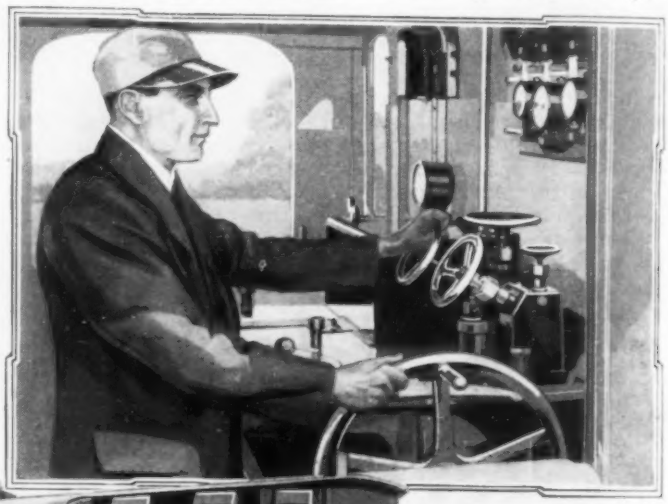
Durable matting from common moss possessing many of the qualities of cork, is being manufactured under a process invented by a Swedish engineer. Aside from being considerably cheaper, it is said to be hard, yet flexible, much lighter in weight and offers insulation against heat, cold and sound. It can be made in much less time than is required for cork or linoleum products and is also adapted for the construction of boxes.

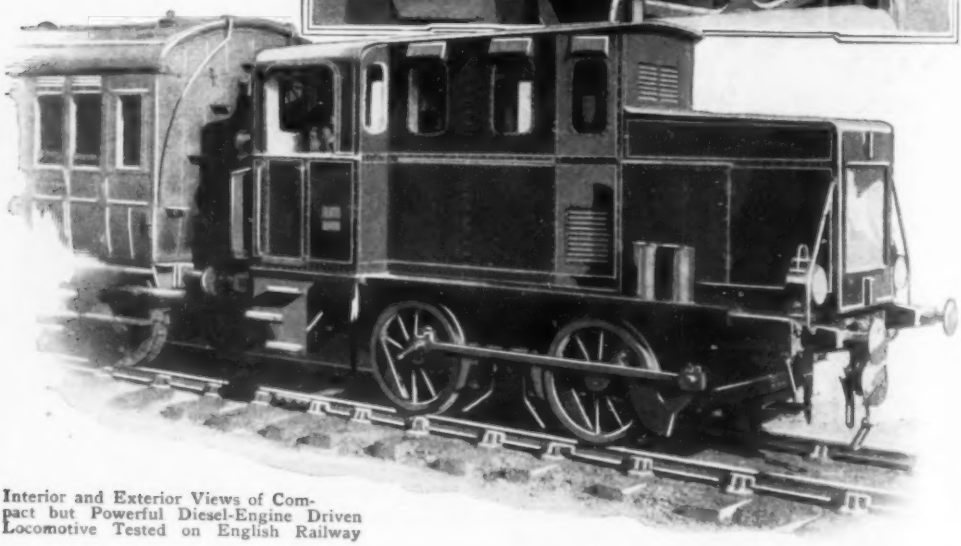
Diesel Engine in Locomotive Hauls Train One Hundred Miles

Used extensively for several years in stationary power plants and in steamships, the Diesel engine, because of its low consumption of oil fuel, is being adapted for railway use in England. Equipped with a sixty-horsepower unit of this type and a newly invented hydraulic transmission system, a locomotive was put through a successful 100-mile test on one of the British lines not long ago. Compactness, light weight and speed are claimed for this engine as well as cheaper operation and absence of smoke.

Auto Hazard in Green Sunshades Avoided by Changing Color

An optical phenomenon, which in its application is increasing the hazards of automobile driving, has been pointed out by scientists who have found that through many shades of green visors, placed on the outside of the windshield to protect the driver's eyes from the sun, the red traffic-signal lights now used in many cities and the stop lamps on cars ahead are scarcely visible. This is caused by the fact that green is the complementary color to red and practically absorbs it when it is seen through transparent material. Recently, a smoky fog or chartreuse-colored visor has been placed on the market, which, tests have shown, permits accurate identification of red, yellow or green lights and also protects the eyes.

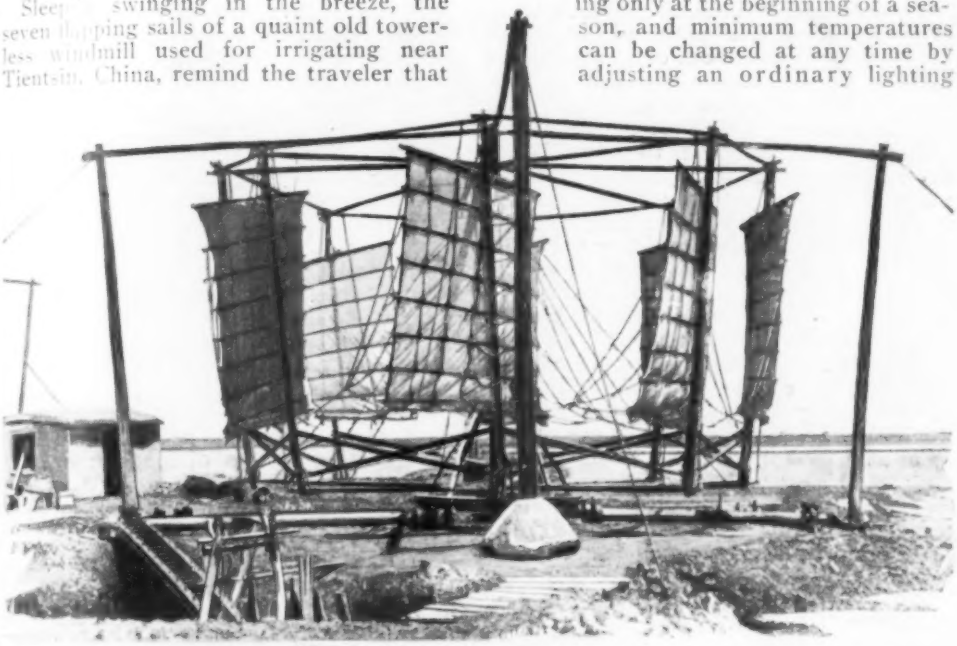




Interior and Exterior Views of Compact but Powerful Diesel-Engine Driven Locomotive Tested on English Railway

Towerless Windmill on Ground with "Merry-Go-Round" Sails

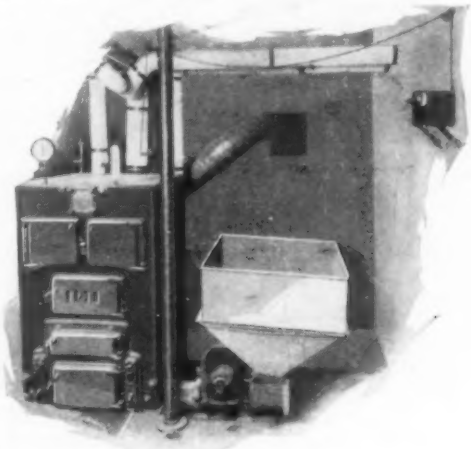
Sleepily swinging in the breeze, the seven flapping sails of a quaint old towerless windmill used for irrigating near Tientsin, China, remind the traveler that although the orient is rapidly adopting modern methods in industry, relics of the past are still abundant, and with characteristic tenacity many of the Chinese yet cling to the ways of their forefathers. Lashed to an elaborate framework of poles, the ponderous sails are set at such angles that if the wind blows hard enough, they manage to turn like a fantastic, creaking merry-go-round, rotating a geared shaft at the bottom of the mill. This operates an endless bucket arrangement that lifts a thin trickle of water from a ditch below into a small canal that runs to the fields.



Antique Chinese Windmill Used for Irrigating; the Seven Sails Revolve in Their Framework, Turning a Shaft That Lifts Water in Bucket Chain from Stream to Canal

Electric Coal Burner Saves Fuel and Ends Smoke Evil

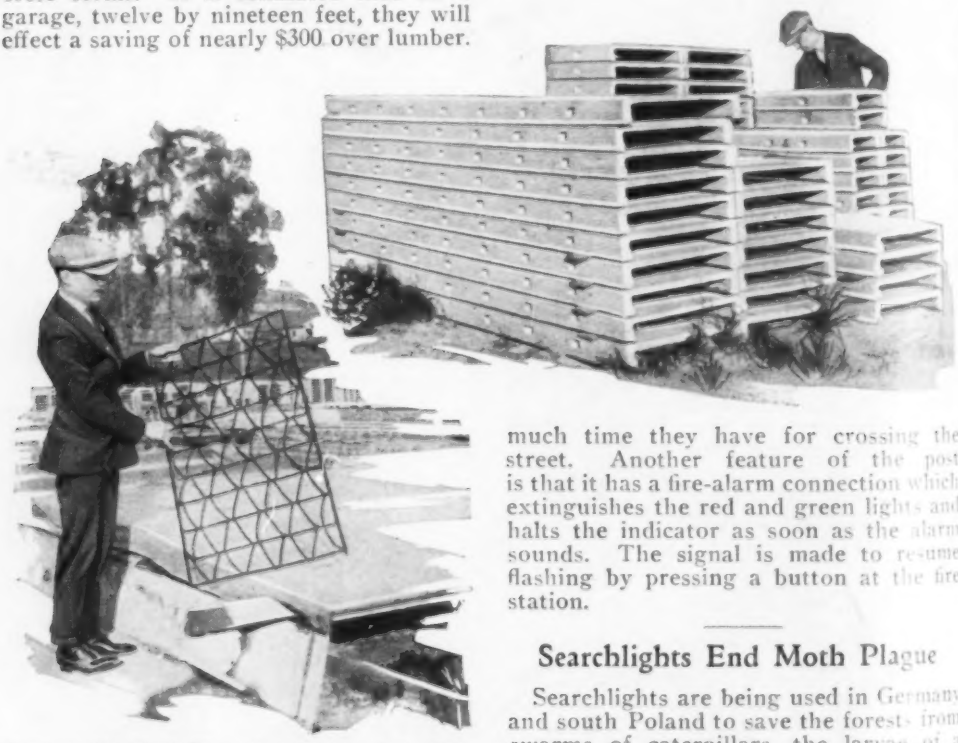
To provide a means of heating buildings and firing small power plants automatically, an electric coal burner that feeds fuel to a furnace when the temperature drops below a certain point, draws its supply from a hopper and deposits the cinders in an ash holder. Designed to operate without other attention, the apparatus requires only the filling of the bin and removal of ashes every three or four days, running and stopping automatically according to the degree of warmth in the house. It is said the heater needs lighting only at the beginning of a season, and minimum temperatures can be changed at any time by adjusting an ordinary lighting switch controlling the air and fuel feeds. During the period of burning, the coal is always in motion and is agitated by a device that insures complete consumption, thus reducing soot deposits and waste. Having few working parts to require replacing, the burner is claimed to accomplish great savings.



Electric Coal Burner That Feeds Fuel and Attends Fire Automatically When Temperature Decreases

Concrete "Lumber" in Place of Wood to Cut Building Cost

To save time and building costs, a western contractor has patented a process for making "lumber" out of concrete. The material is prepared in the form of thin, wire-meshed slabs, weighing about forty pounds less per cubic foot than ordinary concrete and designed to have better fire-resisting qualities. The pieces are made in an eight-foot standard length and in other sizes, in widths ranging from six to twenty-four inches. They are fastened by steel clamping bands and can be used not only as siding but for floors and ceilings as well. Placed on the outside of ordinary concrete columns, they are said to prevent cracking in case of fire and on interior work can be adapted for lathing and plastering and for wooden moldings. Rapidity of construction is claimed for them as they eliminate the need of sawing and driving nails and preparing concrete forms. It is estimated that on a garage, twelve by nineteen feet, they will effect a saving of nearly $300 over lumber.



Concrete "Lumber" Pile and a Section of the Wire Meshing That Gives the Slabs Strength

No seasoning is necessary, it is claimed, and when used in house construction, an outer coating of liquid cement will effectively hide the joints.

Moving Hand on Traffic Signal Adds to Safety at Street Crossing

Fitted with a bell and a large visible indicator that shows how much time there is between the "stop" and "go" signs, an improved electric traffic signal has been installed in a western city and is said to have materially reduced the number of accidents at busy intersections there. The indicator is in the form of a hand moving across a large dial, the upper half of which is green with the word "go" painted in white letters on it and the lower half red with the sign "stop." To the hand is attached a metal shield which travels in a circuit and alternately covers the red and green area and the signs. The instant one side is covered, a bell rings and either the red or the green light flashes, revealing the proper legend. This traveling indicator, which can be regulated to move at various speeds, is of special service to pedestrians as they can easily tell how much time they have for crossing the street. Another feature of the post is that it has a fire-alarm connection which extinguishes the red and green lights and halts the indicator as soon as the alarm sounds. The signal is made to resume flashing by pressing a button at the fire station.

Searchlights End Moth Plague

Searchlights are being used in Germany and south Poland to save the forests from swarms of caterpillars, the larvae of a species of moth. When the lights were set up at night in the woods, millions of the insects, attracted by the powerful rays, were cremated when they flew into the incandescent carbons of the arc lamps, which were not sheltered by globes.

Anchored Golf Keeps Players in Training on Ocean Voyages; Distance Ball Would Travel If Free Is Registered by Pull of String on Dial

Horseback Riding on Ocean Liners

Bicycle Races, Steeplechases, Golf, Tennis and Other Amusements Are Invented for Passengers on Steamers

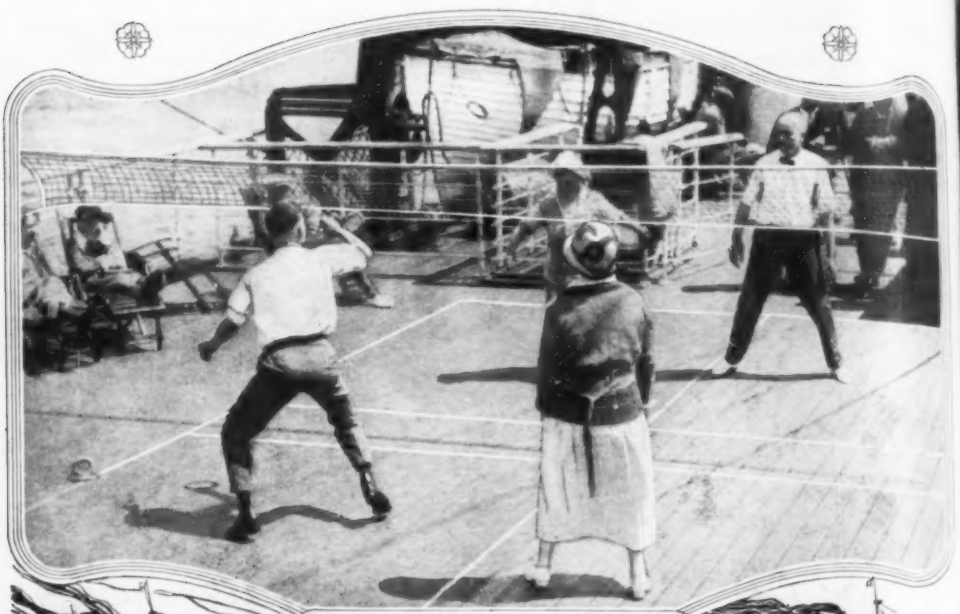
PARALLELING the race for speed and size in the palatial ocean liners, there is a constant search for new amusements to keep passengers interested and contented during the voyage. The old-fashioned turn about the promenade deck, with a band concert in the evening and, possibly, amateur theatricals on the last night at sea, along with the captain's dinner and the grand ball, have been supplemented with elaborately equipped gymnasiums, swimming pools, golf, tennis and a host of other deck games.

Many passengers, for want of something else to do, get more exercise nowadays on an ocean crossing than they take on land. The sea has led in developing games that any amateur can play, from shuffleboard to racing, and it is not at all unusual to see a dignified first citizen from home or his wife indulging in such pastimes as bean bag or a three-legged race before dinner. For the passenger who takes his exercise seriously, however, the gymnasiums of the "Leviathan" and other big American liners; the "Berengaria," "Majestic" and sister Cunard and White Star ships, or such boats of the French and German lines as the "Paris" or "Columbus," offer a wide field of choice.

One of the newest and most popular devices is an electrically operated horse which can trot, canter or gallop at the turn of a switch. One's morning ride through the park can be done on this steed, fastened to one spot on the floor.

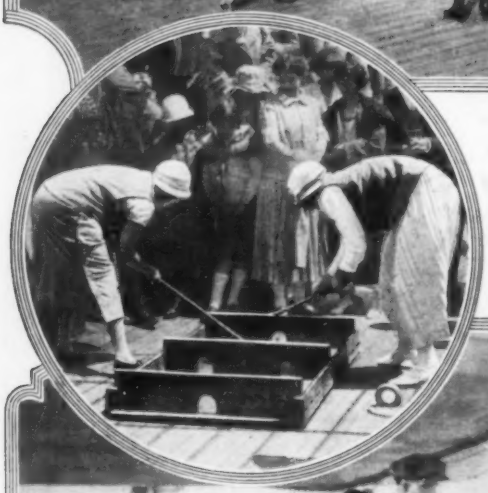
For the amateur boxer who isn't satisfied to keep fit on the weight machines and punching bags, there is a grotesque figure of an opponent, rocking wildly about on its rounded and weighted base at every lusty punch, but always coming back for more punishment on the rebound.

The deck games, open to the tang of fresh salt air, requiring no previous experience and skill, remain the favorites, however. A fair game of tennis can be played on the broad decks, while on some



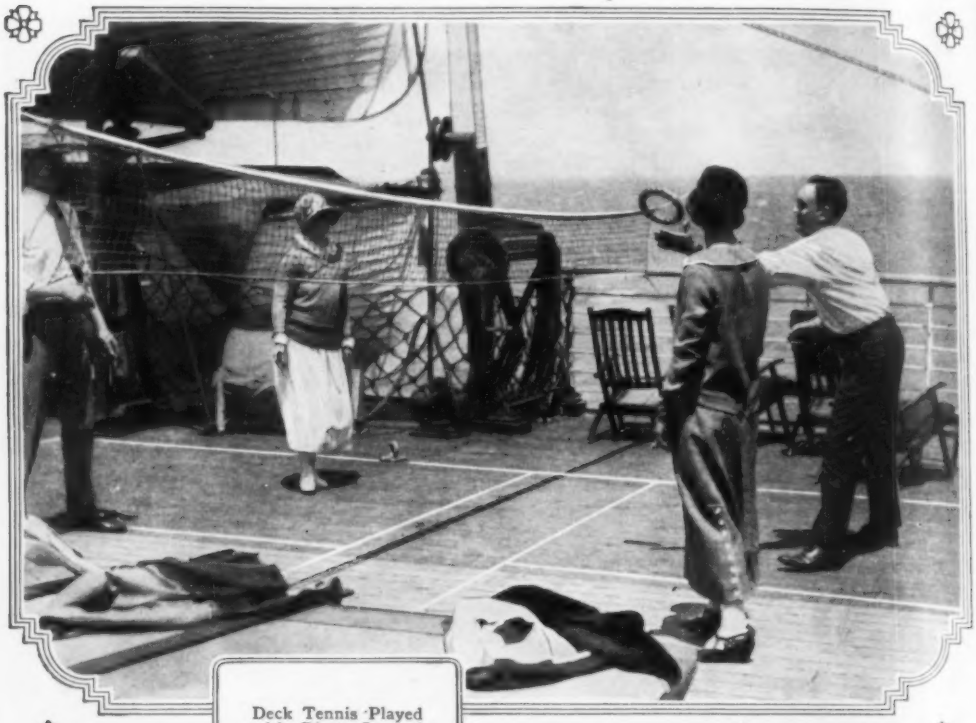
Deck Tennis Proves a Fascinating Sport for Old and Young while Crowds Gather around the "Bookies" Just before an Exciting Afternoon of Mimic Horse Races

Toy Horses That "Gallop" Forward Spasmodically at Varying Distances Determined by the Throw of Dice Give Passengers Thrills of a Real Track

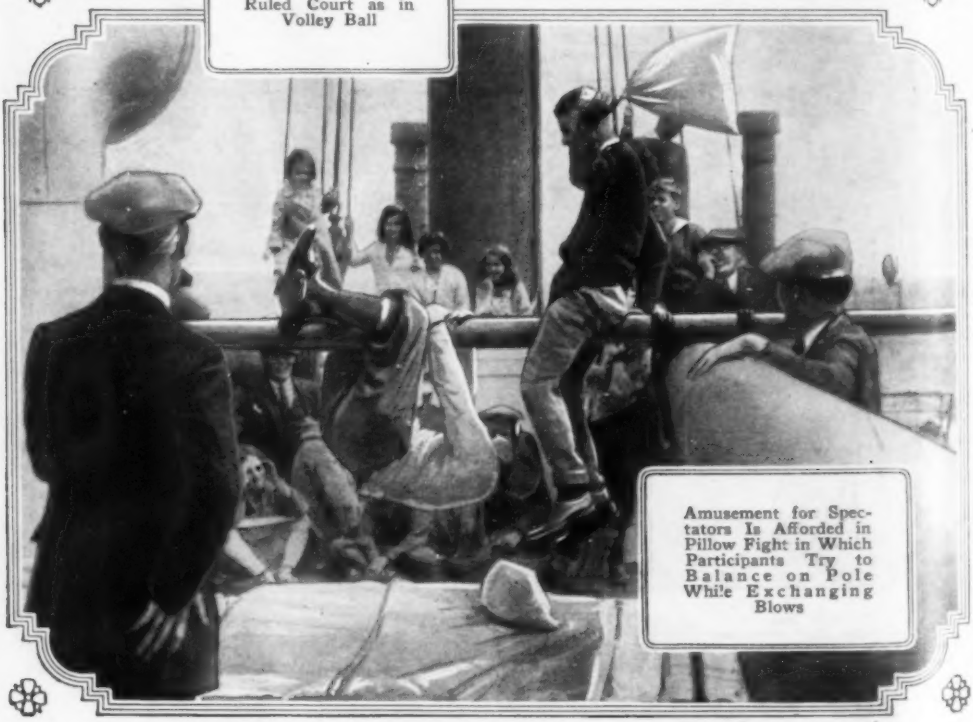


"Bull Board," Played by Pitching Weighted Pads at Figured Squares on an Inclined Plane, Is a Popular Deck Game in Fair Weather as Is Ring Toss, Trying to Throw Rope Loops over Numbered Pegs; Spectators and Players Both Enjoy a Spirited Deck Game, Which Is a Combination Hockey and Mimic Polo Contest Played in a Wooden Frame Which Has Cross Divisions with Gates for the Passage of the Ball

Salt-Water Bathing and Swimming Can Be Enjoyed While the Ship Forges Ahead by Filling Canvas Tanks Rigged to Ropes on Deck and with Ladder for Diving Board



Deck Tennis Played with Rings Instead of Balls and with Net Set High over Ruled Court as in Volley Ball

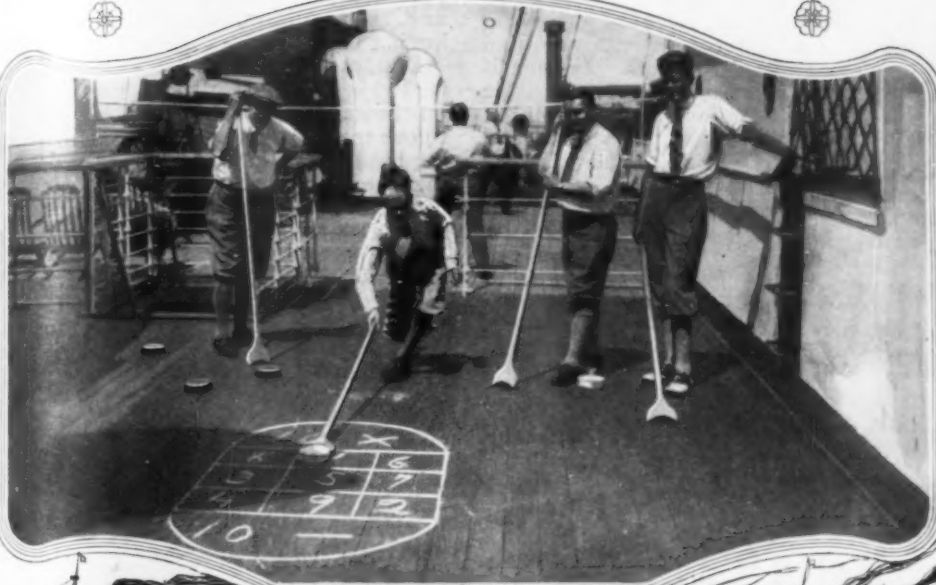


Amusement for Spectators Is Afforded in Pillow Fight in Which Participants Try to Balance on Pole While Exchanging Blows

When Big Passenger Steamers Cross the Equator, Elaborate Ceremonies, Including Mask Balls in Honor of Father Neptune, and Presentations of the Key to the Deep Are Held in Celebration of the Event; Inset and Upper Photo Show the Sea God in Costume and Party during the Action of a Pageant Ball; Below, Father Neptune Surrendering the Key to "Davy Jones'" Locker to a Voyager About to Cross the Ocean; Mask Balls of This Kind Are Favorite Amusements on Large Ships and on Long Cruises. Realistic Costumes Are Often Obtained Directly from the Countries the Fun Makers Represent

Upper Photos Copyright, Underwood & Underwood

Dancing on the Waves Is as Popular as on Land and Impromptu Orchestras of Passengers Add Zest to the Pastime



"Shuffle Board" Long Has Been Favored among Deck Diversions, and Does Not Yield Even to Jazz Such as Is Furnished by Student Orchestra Below

Dancing on the Waves Is as Popular as on Land and Impromptu Orchestras of Passengers Add Zest to the Pastime

liners, particularly on the New York-South American runs, there is an amusing imitation in which rope quoits are used instead of balls and racquets. The net is stretched five feet from the deck and the quoits are tossed across it, to be caught by the opposing player. The rules and scoring are practically the same as in the usual tennis game.

Keeping several hundred passengers amused is a difficult task. On the bigger liners for the comparatively short run across the Atlantic the problem more or less solves itself, but on smaller ships on the longer runs, to South America, Africa and across the Pacific, the problem is more acute. On many of the long-run ships a passengers' sports committee is organized the first day out to plan masquerade balls, bridge tournaments, deck tennis, golf, shuffleboard, spar boxing and other games.

The special tours, where passengers are together for weeks, or even months, provide social directors with as many as a dozen assistants to a single ship. These social leaders are carefully selected by the tour managers, and must be men of exceptional tact and culture, attractive personalities, capable linguists, well versed in the history of the countries to be visited, and, in addition, shrewd students of human nature.

Besides all the other amusements, there is always the sport of betting in the pool on the vessel's daily run. This lends zest to the making of new speed records. Racing has been resumed on the Atlantic during the last year, after several years of quiet. The "Leviathan" started it by hanging up a five-day seven-hour and twenty-minute record from Cherbourg to New York after being equipped with oil burners.

The "Mauretania," veteran of many speed records and sistership of the ill-fated "Lusitania," came back with a five day, three-hour and twenty-minute mark for the 3,098 miles, and later steamed from New York to Plymouth in four days, twenty-one hours and fifty-seven minutes.

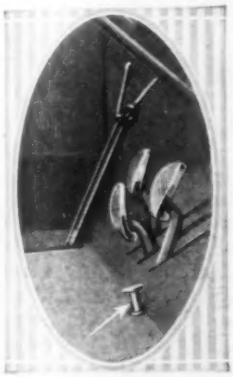
Racing ships across the ocean has been a popular sport since the "Savannah," a 350-ton side-wheeler, cleared from Savannah, Ga., May 24, 1819, and docked at Liverpool twenty-six days later—the first steamer to cross the ocean. She carried sails as well as steam; in fact, sails did not entirely disappear from liners until about thirty years ago.

Girl Student Passengers Stage a Unique and Difficult Deck Race by Trying to Balance an Orange on Top of a Bottle While Hurrying to the Mark at the Farther End

Canaries Are Taught by Phonograph to Sing like Nightingales

Phonograph records are being used by a German bird fancier to teach his young canaries how to sing like nightingales. Almost the minute the birds are hatched, their "lessons" begin, the records, repeatedly playing the nightingale's song, being kept going all day and sometimes far into the night. When the canaries are from six to eight weeks old, they are placed near the cages of real nightingales and are not permitted to hear the singing of any other birds. When they begin to sing, they naturally follow the notes they have always heard, and bring a price about five times as high as that of the ordinary canary.

Touch of Button Oils Auto Chassis Fitted with Lubricator Tank



For lubricating parts of the chassis, an automatic oiling system has been devised to replace grease cups. It consists of a reservoir conveniently placed beneath the floorboards, where it can be filled easily, and from which oil is distributed to the various parts through tubes by pressing a button projecting near the driver's right foot. The tank holds sufficient oil for six months' supply and one push of the plunger a day, or less, is enough to provide thorough lubrication.

Uncle Sam Bakes Loaves of Bread to Test Qualities of Flour

Different kinds of flour are tested in one of the laboratories of the department of agriculture by baking loaves from various samples submitted for analysis and comparing the results for volume. There is often a noticeable difference in the size of the loaves although exactly the same quantities and proportions of ingredients have been used and they are baked under exactly the same conditions. When it is done, each loaf is weighed in special scales and carefully measured. The results are recorded and filed away with the name of the brand of flour tested. Before any sample is officially approved, it must meet certain requirements in the baking tests which are continually being performed to guard against adulterations and inferior qualities.

Government Chemist-Baker and Different-Sized Loaves Produced from Various Kinds of Flour

Hole Cutter for Wood and Metal Is Used Like a Wrench

For cutting round holes from one and a quarter to six inches in diameter easily and neatly in metal, wood or practically any other material, a small device used like a wrench has been designed that does the work in a few minutes. A ratchet handle permits the cutter to be used in any position, against a wall, overhead, in corners or on the floor. Manual pressure is not necessary as a turn of a large nut applies heavy pressure to the knives. Weighing only five pounds, the device can be easily carried to any job or kept on a workbench in the shop.

Ride on Stationary Bicycle Tests the Efficiency of Muscles

Experiments to determine the efficiency of the human muscles are conducted in one of the laboratories at Cambridge university by putting subjects

Rider Taking Bicycle Test for Muscular Efficiency; Breath Is Exhaled into Mask Device

through tests of strength and endurance and studying their performances with special instruments. In the trials, a man mounts a stationary bicycle, which can be adjusted to give varying degrees of friction and is connected to measuring gauges to show speed and the force exerted. As the rider pedals, he exhales into a mask arrangement where the moisture of his breath is collected and later examined and measured. Means are also provided for weighing and examining the perspiration from the man's body. By computing the amount of energy required to operate the bicycle and estimating the bodily fuel consumed as shown by the breath and perspiration, scientists are able to make deductions as to the strength and efficiency of the muscles.

Tobacco Grown in Western Canada Increases Dominion's Crops

While Canada has an annual tobacco crop which goes a long way toward meeting that country's demand for the product, the output has been greatly increased by the successful cultivation of the plant in the western prairie provinces. Although the land devoted to it in British Columbia rarely exceeds sixty to seventy acres, the harvest ranges from 60,000 to 75,000 pounds. Due to the warmth of the valleys and protection from severe weather, commercial tobacco is said to be readily produced. The plants are made up of heavy foliage, are easily cured on the farms and can be made into good cigars and other products. Even in Alberta north of the fifty-fifth degree it has been shown that the crop may be cultivated with little trouble.

Unloading Freight Cars Simplified by Detachable Steel Chutes

For unloading coal, sand, gravel and similar bulk materials from gondola freight cars, a detachable steel chute that fits on the side of the car and dumps directly into the trucks or wagons, has been devised to save time and labor. Reinforced by heavy steel angles and tees, the box holds a cubic yard or more, and by pressing a lever, an outer side door opens and the contents slide into the wagon. While the wagons are gone, the shovelers can fill the chutes for quick unloading when the drivers return. The chutes are easy to attach, are strong and durable and prevent scattering of the material.

Emptying Loaded Chute into Truck While Shoveler Fills Another Clamped to Side of Car for the Next Driver

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Perfect Hit Made by a Battle Plane Using Phosphorus Aerial Bombs during an Exhibition Engagement with a Fleet of Armored Tanks Opposing the "Invading" Airmen

War Tank Is Wrecked by Airplane during Battle Maneuvers

Scoring a perfect hit, an airplane participating in an attack on battle tanks, during maneuvers of the New York national guard, dropped a phosphorus bomb directly on the "enemy." When the cloud of smoke cleared away, the moving fortress was lumbering ahead, although, according to the rules of the contest, it was "demolished and its crew destroyed." Harmless projectiles used by the aviator squadrons cause great puffs of vapor to arise when they explode to show the accuracy of the aerial fighters. Observers keep records of the "strikes" in order to determine what percentage of the missiles find their targets.

Barber Shop on Auto Calls at Homes to Save Patrons' Time

For those who prefer to have their tonsorial work performed at home, an enterprising barber of Wichita, Kans., has rigged up a shop on an automobile in which he calls on his "trade." The arrangement saves time for the grown-ups, since children's hair can be cut according to their wishes without the necessity of accompanying them to an ordinary "parlor." Advance appointments can be made with the "barber shop on wheels," avoiding long waits for the call of "next," and women with bobbed hair can get it trimmed without leaving the vicinity.

Barber Shop on Wheels Which Makes the Rounds of Patrons' Homes to Do Their Hair Cutting

¶Approximately 15,000,000 bananas are consumed every day in the United States.

The "William Crooks," Pioneer Mogul of the "Sixties," Which Recently Hauled a Train of Old-Time Coaches on an Exhibition Run, and Group of "Passengers" Costumed in the Fashions of Its Day

Permanent Steel Headboards for Berths of the New Mountain Type of Sleeping Car and, Right, Interior of Old "Number Nine," the First Palace Car, and a Luxury of Sixty Years Ago

How Pullman Cars Are Named

Care and Judgment Used in Selecting Titles for Wheeled Palaces That Make Long Railroad Journeys Enjoyable

AFFORDING the tired traveler a haven of rest and comfort amid luxuries that have converted long, tedious railroad journeys into sojourns of enjoyment and safety, the Pullman car of the present severely contrasts with its boxlike ancestors of sixty years ago. The first "palace" sleeping car, built in 1858, was composed of two day coaches remodeled and combined in one. The berths were crude affairs compared to the elaborate, cosy beds which are now made up nightly by the busy porter.

While the early types of parlor and sleeping cars were less than fifty feet long, a massive length for those days, the present models stretch for almost twice that distance. Steel, both inside and outside, has taken the place of wood for construction. But the painters' art has so thoroughly disguised the metal, that it resembles highly finished mahogany where used on the interior. Soft, velvety carpet covers the floors from end to end, laid over a magnesite composition that is reinforced and protected against cracking by special corrugated steel sheets.

Approximately 300 cars are built yearly by the Pullman company at a cost of about $38,000 each. Although the life of the metal car has not been determined, that of the modern wooden type is placed at twenty years. Repairs and replacements of worn parts, however, often greatly increase their term of service.

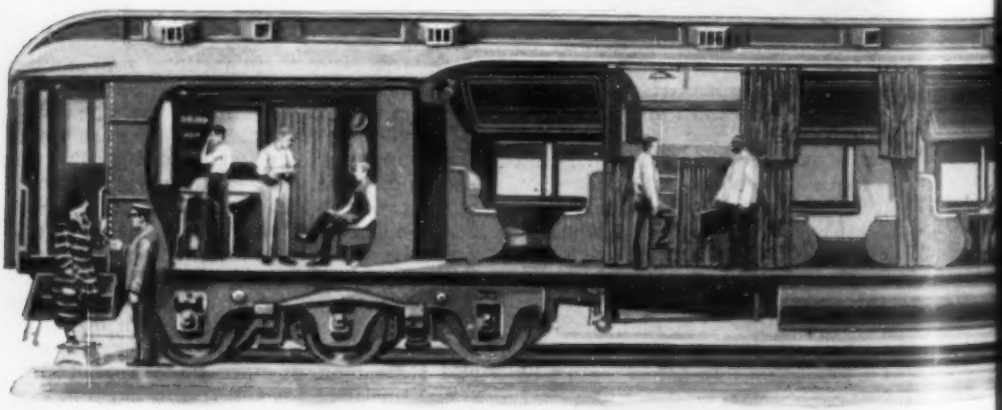
Romantic and poetic names that grace the sides of the cars were early substituted for numbers to prevent mix-ups in recording rolling stock among the various railroads. Names of countries were first employed. Then, as many railways expressed desires to have their stations represented by such Pullman cars as might be allotted to them, towns and villages were selected. When dining and commissary cars made their appearance, these were given the names of popular chefs of history, among whom were such as Aberlin, Magdelin, Savarin, and Valentin, whose savory dishes once tempted the appetites of France's royalty. Prominent hotels of this and other countries also were selected as names to identify the diners.

Birds, flowers, lakes, rivers, and poets and statesmen of note have been represented in titles for the rolling parlors and lounging rooms. Recently a new type of sleeper was constructed, known as the

How Overnight Travelers Enjoyed the Scant Quarters Permitted in Gloomy, Crowded Coaches before the Days of the Palace Car, as Seen by an Artist of That Time

mountain-type car, not because this model is for use in hilly sections but on account of the series of names attached to them, all of which are composed of the word "mountain" and one other, such as "Mountain Lake," "Mountain Glen," and similar combinations.

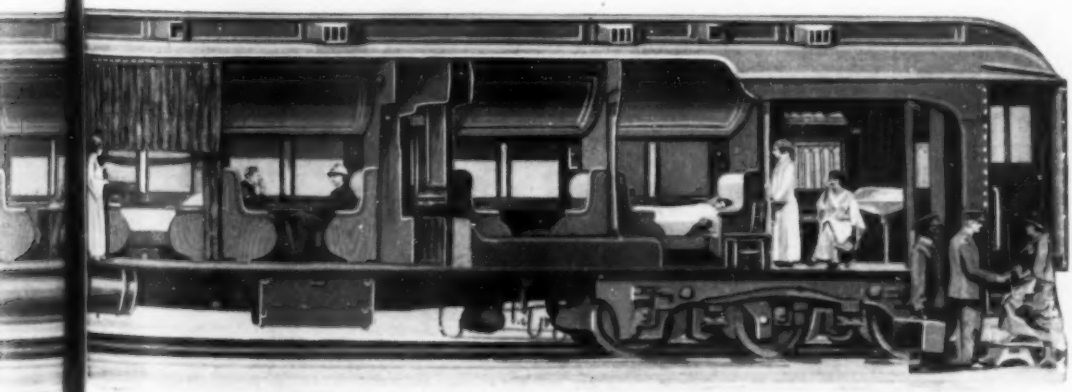
Names are selected by the Pullman company officials, who study them from every angle before they are permitted to ornament cars. Seldom is an outside individual allowed to christen a car, and it is said the method of selecting names which might interest patrons, serves to arouse a desire in the minds of the public to learn something of the originals of them. For this reason, authors, historical figures, prominent places, rivers and provinces of



Sectional View of Pullman Car Showing Elaborate Conveniences Afforded Travelers Who May Embark on a Long Journey amid Restful Surroundings Found in Most Up-to-Date Homes

Old Open-End Coaches of a Type Now Rapidly Passing from Use to Make Way for the Solid Vestibule Trains That Aid in Providing Comfort and Safety for Both Passengers and Crew

far-off lands, are believed to fill a double purpose when applied to a train of ornate coaches that help to make life comfortable for professional travelers and railroad journeys attractive to tourists. Of course many names are submitted by employes of the car builders and members of railroad staffs, but all are subjected to the test before sanction by those charged with christening the cars. It is believed the only "outsider" considered under the rule was Joseph Jefferson, the actor, who became famous in the role of "Rip Van Winkle." At his request a car assigned to him for use during his tours was renamed with the title of his popular play.



Well-Lighted Interiors and Cozy Beds, Artistically Concealed during the Day, Convert the Sleepers into Ornate Rivals of the Best-Furnished Hotels When Night Arrives

Cypress Ship, Sixty-Eight Feet Long, to Sail around the World

Paving the way for progress in navigation that is expected some day to make cities on the Great Lakes and along the Mississippi ports for ocean steamers, a little cypress ship, sixty - eight feet long, slipped out of Chicago recently for a two - year trip around the world. She entered from Lake Michigan through the Chicago river, passed through the Illinois - Michigan canal into the Illinois river and thence to the Mississippi and the Gulf, the first ocean-going ship to make the route in several generations. While it was announced that the voyage was ostensibly for the purpose of making motion pictures of the tree-climbing fish and other wonders of tropic islands, the principal object of the undertaking is to establish commercial relations with foreign ports looking to the day when a Great Lakes-to-the-Gulf waterway will link inland United States directly to harbors abroad.

With Sails Set, the All-Cypress Ketch "Big Bill" Starts on Her Two Years' Cruise around the World for the Promotion of Commercial Relations

The craft is of the style known as a ketch and is designed after the boats used by Norwegians in carrying fish to England. She has a sixteen-foot beam and is equipped with a radio broadcasting apparatus with a range of 3,000 miles, a phonograph, gas stoves and an elaborate array of maps, and carries an auxiliary power plant in a kerosene-burning engine. Considerable interest was aroused by the fact that the ship was not painted above the waterline, this being thought unnecessary in view of the durability of the wood.

Making Weather for Workers Aids Quality of Factory Products

Manufacturing the "weather" inside large industrial plants by constant control of the temperature, humidity and circulation, has come to be a necessity in several lines. It allows routine processes to be followed regardless of the behavior of the elements outside, standardizes the product, increases the output and tends to lower costs. Many large firms have therefore installed elaborate air, heat and moisture-regulating apparatus in their workshops. In the rubber industry particularly, this has been found important. When drying rubber, for instance, a continually even temperature is essential to insure a uniform quality and, in cementing, it is necessary that evaporation and other processes occur under even conditions to avoid weakening the rubber and causing blisters.

Thistles Prove Profitable Crop

Edible thistle buds, closely resembling artichokes, are among the profitable crops in certain parts of California where soil and climate seem ideally suited to the cultivation of this variety, a huge Mediterranean species with large spines and big purple flowers and which does not seem to thrive elsewhere in this country. The

buds are sold for as much as twenty-five cents a piece and are highly esteemed as a table delicacy. Growers cultivate them in such a way that they are ready for market at a time when there is little competition with other products, the harvest beginning in October and reaching its peak about the first of April. Last year, 500 carloads were shipped, the bulk of the crop going to cities in the east where the demand for artichokes has greatly increased.

Roadside Scale for Weighing Autos Aids Traffic Survey

Highway inspectors engaged in a survey of automobile roads and traffic in Illinois, were aided in their work by a portable scale for weighing vehicles without causing great delays or inconvenience to the drivers. The outfit was placed under a small inclined platform at the side of the road where automobiles could be run upon it with little trouble. Weight on each wheel was plainly registered on the dial as the autos passed over the scale. While the weighing clerk was making his notations, other inspectors quizzed the drivers to find out the origin and destination of the vehicles, the kind of business engaged in and the sort of load carried. The information is to be used in making a scientific analysis of traffic conditions looking toward the construction of improved highways.

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Weighing Auto on Portable Platform Scale during Traffic and Highway Survey

Portable Darkroom Worn as Hood Aids Traveling Photographers

When regular darkroom facilities are not available, photographers may have a practical substitute in a portable one in the form of a close-fitting piece of rubber material that slips over the head like a hood. It contains a square of ruby glass for developing and changing plates, etc. At the bottom, it fits tightly to the body so that no light is admitted, but its folds are loose enough to permit ample freedom for the arms and hands. It can be quickly wrapped into a compact package and fits in a small space in the camera case.

Photographer Wearing Darkroom Hood with Square of Ruby Glass Visible in Front

Green Lumber Reduces Home Cost by Using Calked Seams

A process by which green lumber can be substituted for seasoned material in building outer walls for frame houses has been discovered by a Swedish inventor who uses thin boards with straight edges instead of the tongue-and-groove joint. To take up the shrinkage and warping during the drying period after the planks have been put in place, the seams are well calked and covered by protective wood strips which are removed while the lumber is shrinking so the filler can be driven farther into the openings. When the weatherboarding has been thoroughly seasoned, which generally requires about eight years, the strips are permanently fastened.

Cement Guards Lights of "White Way" from Wind and Heat

To combat the heat of the lamps and jarring caused by traffic, the light sockets

Copyright, Keystone View Co.

Pouring Protective Cement over Sockets and Wire Contacts of a Newly Built Electric Sign

of electric signs seen along the nation's "white ways" are anchored in place by strong iron bolts and kept from working loose by a mixture of waxlike cement that resists the warping of metal frames due to weather changes and prevents short circuits caused by broken wires. After the signs are wired, the composition is poured over each socket, locking the connections in a mass of flinty material that can only be removed with a chisel. It is said this method keeps the apparatus in good condition for many years.

Safety Powder for Blasts in Mines Decreases Number of Fatalities

Nearly seventy-five per cent of the explosives used in the United States are consumed in the mines, according to figures prepared by William W. Adams, statistician of the department of the interior. His report, prepared for the bureau of mines, shows that coal mining last year required 270,124,438 pounds of explosives and that 56,806,709 pounds of this were of what is known as the permissible class, a dynamite that has a short flame, emits but little fume and is approved by the mine bureau after tests for use in shafts where gas and dust are likely to be found. In 1902, only 11,300 pounds of this short-flame powder were used in coal mining, or less than one pound for every 1,000 tons of coal mined, while now from seventy-seven to ninety-three per cent of the permissible explosives manufactured are used for the coal-mine "shots," or about eighty-nine pounds for every 1,000 tons of coal. The increased consumption of safer forms of explosive is regarded as an important factor in reducing the number of deaths and injuries in mines.

Hoisting Tower on Auto Saves Time in Construction Work

Made of light angle iron, a hoisting tower has been mounted on the rear end of a small auto truck by a cement contractor to save time in moving from one job to another. The apparatus, capable of lifting and dumping a wheelbarrow load of cement, is operated by the motor of the car by means of a cable around a drum and a series of sprockets, one attached to the rear axle. When in operation, the rear end of the machine is blocked up. To move it it is only necessary to take off the chains on the sprockets and lower the tower upon the truck.

Hoisting Tower on Rear of Auto Truck, Lifting Wheelbarrow Load of Cement

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Water Bicyclists in Formation at Sports Carnival on Seine

Queer Water Bicycles Add Thrill to River Carnival Sports

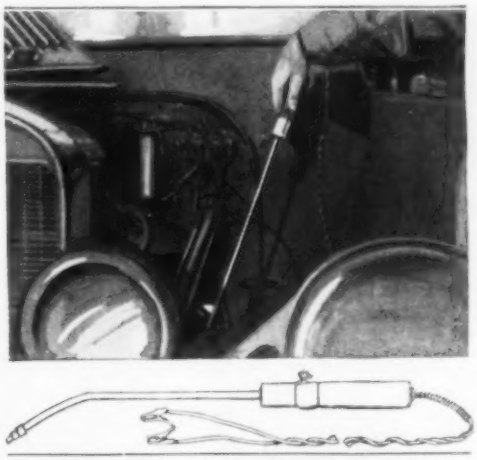
At a carnival on the Seine, spectators were given a novel entertainment by the performance of a company of water bicyclists. Supported by two boat-shaped pontoons and seated upon a strong framework rigged between them, the riders pedaled their singular craft in a series of drills, races and formations. Easily steered by the handlebars, the craft are said to be capable of considerable speed and, in quiet water, require but little exertion to operate them.

Gold-Coated Glasses Admit Light But Halt Glare and Heat

Gold-coated spectacles, which admit light but bar heat and glare, have been perfected for workers who face the high temperatures and intense rays of metal-working furnaces. The coating is much thinner and more uniform than the finest gold leaf, and is placed on the glass by distillation in a vacuum. In use, the deposit gives a slight greenish tint to the light that passes through. The first application of the discovery was to motion-picture projectors, where a small disk of the glass interposed between light and film eliminates danger of fire, and makes it possible to stop at any point to view an individual picture. The discovery is expected to be particularly valuable in the use of movies to teach natural sciences in schools, the instructor being able to halt the picture to discuss any view.

Magnetic Rod Helps in Picking Up Bolts and Bits of Metal

For use in picking up nuts, screws or other bits of metal out of motor transmissions or from places hard to reach with the hand, a flexible magnetic rod has been invented. The magnetizing device is controlled by a thumb switch at the base of the handle and served with electric current through cords that can be easily clipped on any ordinary battery terminal. Because of its ability to pick up from one to two pounds at a time and the fact that it



Magnetized Rod in Use on Auto, and Diagram Illustrating Thumb Switch and Connections

can work in grease, oil or water, the rod is also useful in taking out or putting in bolts otherwise hard to reach.

At the Portals of a Luxurious Modern Hotel Where Guests Find Comfort Arranged for Them by an Army of Watchful Attendants, Each Trained in the Part of a Host

Housekeeping on a Gigantic Scale

Factory Methods of Standardized Production Applied Even to Serving of Your Meals by Modern Hotels

TO the manager upstairs in his private office, the kitchen of a great hotel is simply a factory where perhaps 10,000 products are made to order in the space of two hours and delivered within fifteen minutes. Quantity production and standardization of service have made housekeeping possible on a wholesale scale.

If each individual waiter and bus boy were permitted to perform his tasks in what he believed the best way there would be such a scurrying and running about that hopeless disorder would result. Therefore the great restaurants and hotels have established a system to control every move. When you take your seat at the table, the bus boy and waiter perform certain tasks while you study the menu. They place the silver, provide napkins, bread, butter, possibly service plates, glasses of chopped ice, and finally the water carafe. In one great hotel chain, when two diners are being served, the water is exactly the thirty-ninth item which goes on the table, and, before the dinner has been finished, 100 or more separate articles will have been produced, used, and then removed.

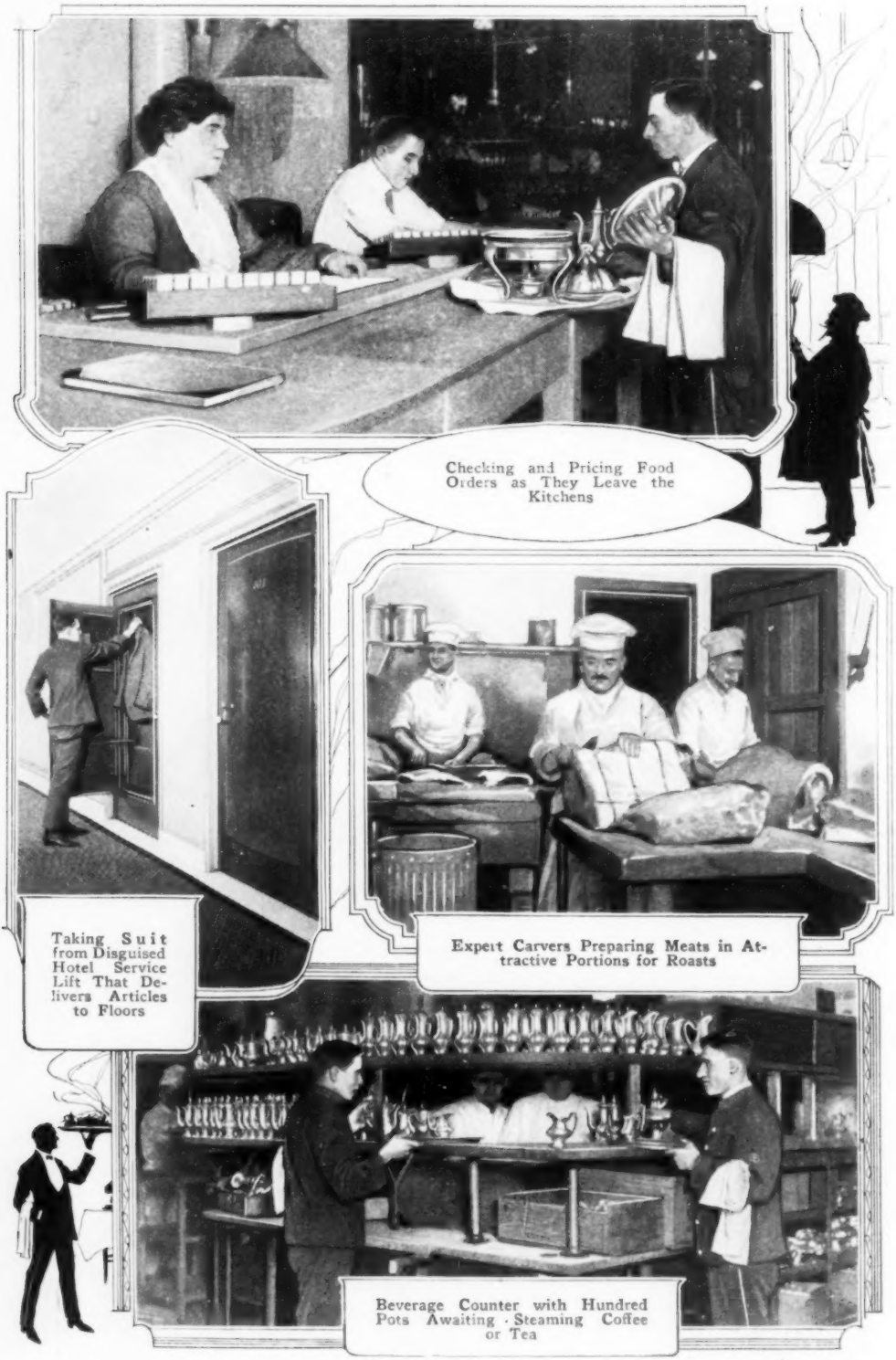
The food-service department shows housekeeping on a huge scale at its best, and here the mechanical appliances which save time primarily are most abundant. The hotel steward, looking over past records, can tell how many guests probably will order soft-boiled eggs on any given day of the year, but getting them boiled and served is another matter, which probably would keep an army of cooks busy, were it not for the mechanical egg boiler.

Clockwork, driven by a lead weight, or

Palatial Hotel Dining Room Where Scores of Alert Servants Care for Wants of Several Hundred Patrons at Once

Kitchen Bulletin Board on Which Special Items Are Posted for Benefit of Waiters and Checkers

Hotel Bakery Which Daily Prepares Stacks of Homemade Pies and Pastries



Checking and Pricing Food Orders as They Leave the Kitchens

Taking Suit from Disguised Hotel Service Lift That Delivers Articles to Floors

Expert Carvers Preparing Meats in Attractive Portions for Roasts

Beverage Counter with Hundred Pots Awaiting Steaming Coffee or Tea

During Parents' Absence Child Guests Are Entertained in Hotel Nurseries

Registering at the Desk Where Guests Are Allotted Rooms and Become Part of the Big Hotel Family

Tasty Salads Are Prepared by Expert Artists Schooled in Making Dressings and Elaborate Dishes of Fruits and Greens

Putting Music in Voices of Pages Who Call Guests

a small electric motor, furnishes the motive power, and when an order for eggs comes, the cook drops them in a metal basket, lowers it into a tank of boiling water, and sets the indicator for the time required, at the expiration of which the eggs are automatically lifted from the water. The slicing of bread offers another opportunity for a machine to give satisfaction to the guests by a uniform product, in addition to saving material. A revolving circular disk divides the loaf with a smooth motion, while a ratchet advances the bread just the width of another slice, for the next cut. The cold-meat slicer works on a similar principle, and the vegetable parer used principally for potatoes and carrots is another example.

Aside from appliances for handling food, there are several instances of time-saving in the serving and housekeeping departments of the great hotel. The telautograph ably supplements the intercommunication service of the telephone, saving time for messages which do not require direct conversation between sender and receiver, as the handwriting inscribed at the transmitter is reproduced at the receiving instrument.

The telephone installation is, of course, the major means of communication and it may easily equal that of a good-sized central office. In one hotel the branch exchange serves 3,340 telephone instruments, seventy operators being required to handle the calls.

Standardization of service, equipment and supplies, however, does not stop with the kitchens and dining rooms. One hotel system, for example, has made a study of every item of equipment, from carpets to chinaware, and tries to produce anything which could be manufactured by itself more cheaply than it could be purchased in the market. This company built a decorating furnace and now buys all china in the white and does its own decorating.

The same group of hotels, in its factory, operates an upholstery shop, candy factory, printing plant, a garment factory and a furniture-repair plant. Standardization also has been extended to such articles as table linen, glassware, soaps and cleaning materials, and even such staples as baking powder, olive oil, vanilla extract, coffee and canned goods. As a result $350,000 has been released from the inventory and $100,000 a year saved.

The modern hotel manager, therefore, is justified in thinking of his plant as a factory which takes interchangeable parts and fits them together into a custom-made product, no matter whether it is room service and equipment or your dinner.

Mail and Information Desk, a Valuable Source of Counsel for Strangers and Guests Seeking Advice and Guidance Regarding Massive Hotels and Their Maze of Halls and Departments

Highly Trained Waiters Often Render Valuable Aid to Diners Selecting Their Meals

Private Switchboard and Operators of a Hotel's Telephone System

Corps of Cooks and Their Battery of Polished Copper Pots and Pans

Great Care Is Taken to Leave Kitchens Spotless after Meals

Meals Are Served in Rooms from Pantries on Upper Floors

Fulton's Statue Saved from Wreck of Old Ferry Station

One of the first objects to be cared for in dismantling the abandoned ferry building under Brooklyn bridge, was the large

Workmen Lowering Robert Fulton Statue from Abandoned Ferry Building That Bore His Name

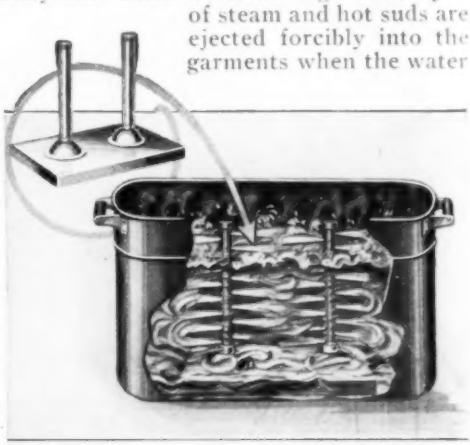
statue of Robert Fulton for whom the structure was named. The massive monument was lowered with block and tackle and removed to a safe place. For years, the figure faced the river, teeming with craft that his genius had helped to make possible.

Safety of Shotgun Barrel Depends on Skill in Making It

When the hunter fires his shotgun, exploding a charge of powder with a bursting force of from 50,000 to 65,000 pounds to the square inch against a metal strip not more than three-sixteenths of an inch thick and within a few inches of his head, he seldom stops to consider the vast amount of care, scientific knowledge and workmanship that have gone into the barrel to make it safe and accurate. In general there are two classes, the twisted or Damascus barrel, and those made from solid bars without twisting. The material is a mixture of iron and steel, since steel alone is too brittle to stand the shock of the explosion and pure iron too soft. Checkerboard, chain, diamond and other patterns may be obtained in the barrel by different arrangements of the steel and iron rods before they are heated and welded into square bars and finally twisted. Usually the bar is heated, one end placed in a square hole, and is then given eight twists to the inch with a winch handle and cog wheel. After twisting, the rods are rolled into ribbons with the edges beveled the same way, two being required for a single barrel, the one for the breech somewhat thicker than that for the muzzle. Then they are twisted cold into a spiral, again heated, and after a steel mandrel has been inserted, hammered until cold. The "solid weldless twist" barrels, commonly seen, are made by simply twisting a bar of metal of the proper composition and boring out the center. A Damascus barrel of average quality will last about thirty years and will stand the firing of 100,000 shots provided it receives good care, it has been found.

Percolator in Wash Boiler Cleans Clothes Easily and Quickly

Out of an ordinary household boiler, an efficient washing machine can be formed by placing in it a patented antomatic clothes percolator which is said to cleanse all kinds of fabrics thoroughly in thirty minutes. It consists of a copper base and two hollow upright posts, perforated with sixty-four small holes through which jets of steam and hot suds are ejected forcibly into the garments when the water



Clothes Percolator in Action; Sixty-Four Steam Jets Churning through Fabric and Water

reaches the boiling point. This action is kept up automatically, the washer requiring no further attention or handling. There are no parts to get out of order or tear delicate fabrics, the maker claims.

Underseas Survey of Gulf May Aid in Forecasting the Weather

Submarine surveys of the Gulf of Mexico, the Caribbean sea and adjacent waters are to be made by a government expedition of scientists, who, equipped with the latest sounding and other apparatus, hope to reveal many of the hidden wonders of the deep. The cruise is expected to continue through the Panama canal and down the western coast of South America to the islands off Peru. The Gulf-Caribbean region is considered of great importance to the United States as many of the weather changes in the southern and mid-western states have their origin there, and it is hoped that much will be learned of ocean currents and temperatures which will be of aid in weather forecasting. Off the Louisiana and Texas coasts and sometimes near Central America and Peru, oil spots occur on the water and it is desired to learn if there is any connection between these supposed submarine gushers and the oil fields on land. It is also pointed out that, although the gulf abounds in valuable fish, little fishing is done there, and the expedition will investigate the possibilities in this direction.

Whole-Wheat Bread without Flour Made Directly from Grain

Transforming wheat directly into bread dough without the necessity of a flour-milling process, has been successfully accomplished by an ingenious contrivance of French manufacture. The apparatus consists principally of a large screw-threaded cylinder which crushes the whole grains into a mixture of the consistency of smooth paste. The wheat is first thoroughly washed and allowed to stand six hours in tepid water. Yeast and salt are then added before the soft, swollen kernels are put into the crusher.

Arrow Thriller in Movie Is Made by Turning Camera Backward

While many of the thriller scenes in motion pictures are genuine and done at the risk of life, others are produced by clever illusions that sometimes deceive the eyes of the most critical observers. In filming a recent picture, one of the characters was shown captured and bound, while arrows, evidently shot from hostile bows, traced his outline on the tree trunk as they imbedded themselves in the bark. The effect was obtained by first carefully inserting the shafts around the figure and then pulling them out while the camera was cranked backward. In the finished reel, the arrows appeared to be thudding forcibly against the tree within a hair's breadth of the actor who increased the effect by appropriate flinching and facial expressions.

Staging the Arrow Thriller; with Threads Invisible in Finished Film, Shafts Were Pulled Out While Camera Was Cranked Backward

¶Nearly one-half of the world's supply of zinc is produced in the United States.

Furniture Made without Nails Wins First Prize for Boy Scout

Fashioned without the use of a single nail, a table, chair and ornamental lamp

Scout Robert S. K. Brown of Boston with Prize Furniture He Made without Nails

made of rough pieces of wood firmly joined, won first prize for a boy scout craftsman at an exhibit in an eastern city. Withes of wood were interlaced to form the seat and back of the chair and the table top, while the lamp shade was constructed of thin pieces of bark and carving on the stand added to its appearance.

Perfume Supply Is Periled by Ban on Killing of Musk Deer

Musk, one of the most costly and effective substances in "fixing" perfumes, may soon be dearer than rare jewels because the lamas of southeastern Tibet have decreed that hunters caught killing the musk deer will have their hands cut off and nailed to the temple doors. According to Dr. Joseph Rock, explorer for the National Geographic society, the animals are becoming very scarce, due to the perfumers' attempt to satisfy the demands of fashion. This has led the lamas to restrict hunters. Other animal substances commonly used in the manufacture of perfumes are the precious ambergris, from the whale, castor from the Canadian beaver, and civet from the civet cat of Abyssinia and India. None of these odors is used by itself, but when mixed with the oils of flowers, they magnify the natural fragrance of the blossoms and serve to make more permanent perfumes that would soon become weak with age.

Portable Highway Speeds Autoists across Shifting Desert Sands

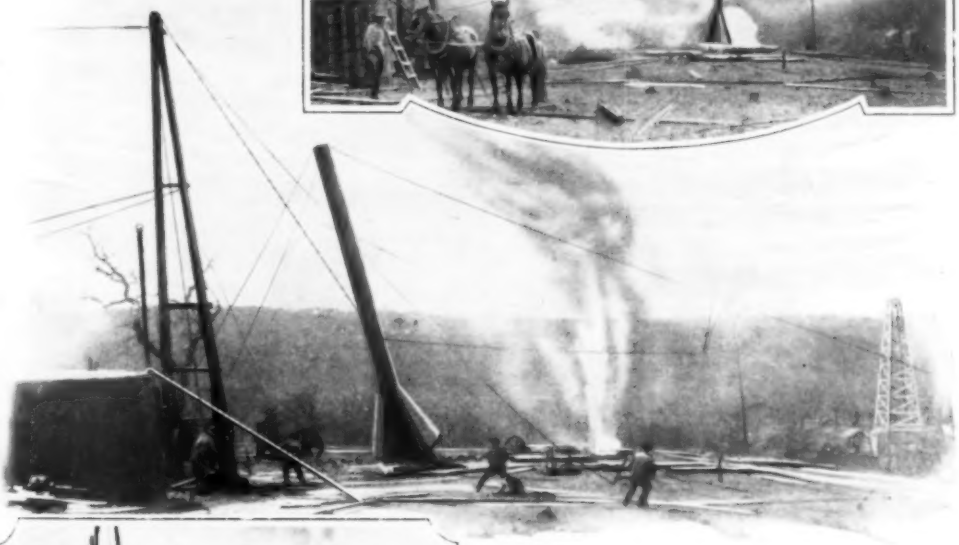
In order to carry automobile tourists over a five-mile stretch of shifting sands in Death Valley, a portable highway has been devised by the California road commission. It is constructed of sections of redwood blocks and timbers laid flat on the surface and bolted together. If windstorms cover them up, a tractor, equipped with a crane and hanging hooks that fit into the eyebolts screwed into the wooden lengths, speeds to the scene, quickly lifts the sections, shakes them free of sand and re-lays them. Aside from its portability, this roadway has the advantage of not cracking under the intense heat.

Switchless Auto Stop Light Is Run by Drop of Mercury in Tube

Switched on or off automatically by the movement of a little ball of mercury within a hard-rubber tube, a novel stop light for automobiles has been invented that works independently of the brake pedal and requires no attention from the driver. Resembling other lights in outer appearance, it needs no electrical connections save a wire to a storage battery and has no mechanically operated switch likely to get out of order. In the housing just beneath the bulb, two protruding nickel contact wires are arranged within the tube in such a way that when the forward movement of the car is checked, the mercury, also inclosed in the tube, moves against the ends of the wires, thereby closing the circuit and lighting the bulb. When the car is started, the mercury regains its former position and the light goes out. A U-shaped bend in the tube acts as a baffle, preventing the mercury from operating the light when the car is driven over rough roads.

Gas-Well Fires Put Out like Candle by Smothering with Snuffer

Extinguishing the geysers of flame that shoot from natural-gas wells when they are accidentally ignited by lightning, sparks from small stones hitting the casing, brush fires, or other causes, is often successfully done by an adaptation of the old-fashioned snuffers our forefathers used to put out their candles. This means is but one of several employed in combating the fire demon which in a ten-year period destroyed five billion cubic feet of gas and annually takes its toll in human lives and millions of dollars. The extinguisher consists of a metal hood mounted on wheels and terminating in a valve to which is attached a piece of fourteen-inch pipe, about twenty feet long. This can be extended to any desired length by screwing on more joints. On either side of the hood, midway of its height, is a short piece of ten-inch pipe also containing a valve. The entire apparatus, assembled near the scene of the fire, is made ready for operation by adding the extensions if needed and placing the hood directly over the flames by means of block and tackle. By proper manipulation and closing of the valves, according to the size of the fire, the flow is quickly shut off and the blaze smothered inside the metal hood. Not long ago, in Oklahoma, this method was used to put out a fire and when the flames had subsided, it was found that the well produced 40,000,000 cubic feet of gas daily.



Erecting the Big Steel-Hood Snuffer over Flaming Gas Well to Extinguish the Fire

Glider in Air Nine Hours

Sweeping about the sky in long, circling "figure eights" in a "flivver" airplane with the motor and propeller sealed, Lieut. Thoret, a French aviator, broke all previous gliding records when he remained up for nine hours and four minutes at the Alpilles field. At one point, he climbed to an altitude of 4,000 feet.

Over the Mountains with White Coal

Mile-Long Railway Trains Sped over Top of the Continent by the Harnessed Power of the Rivers of the Rockies

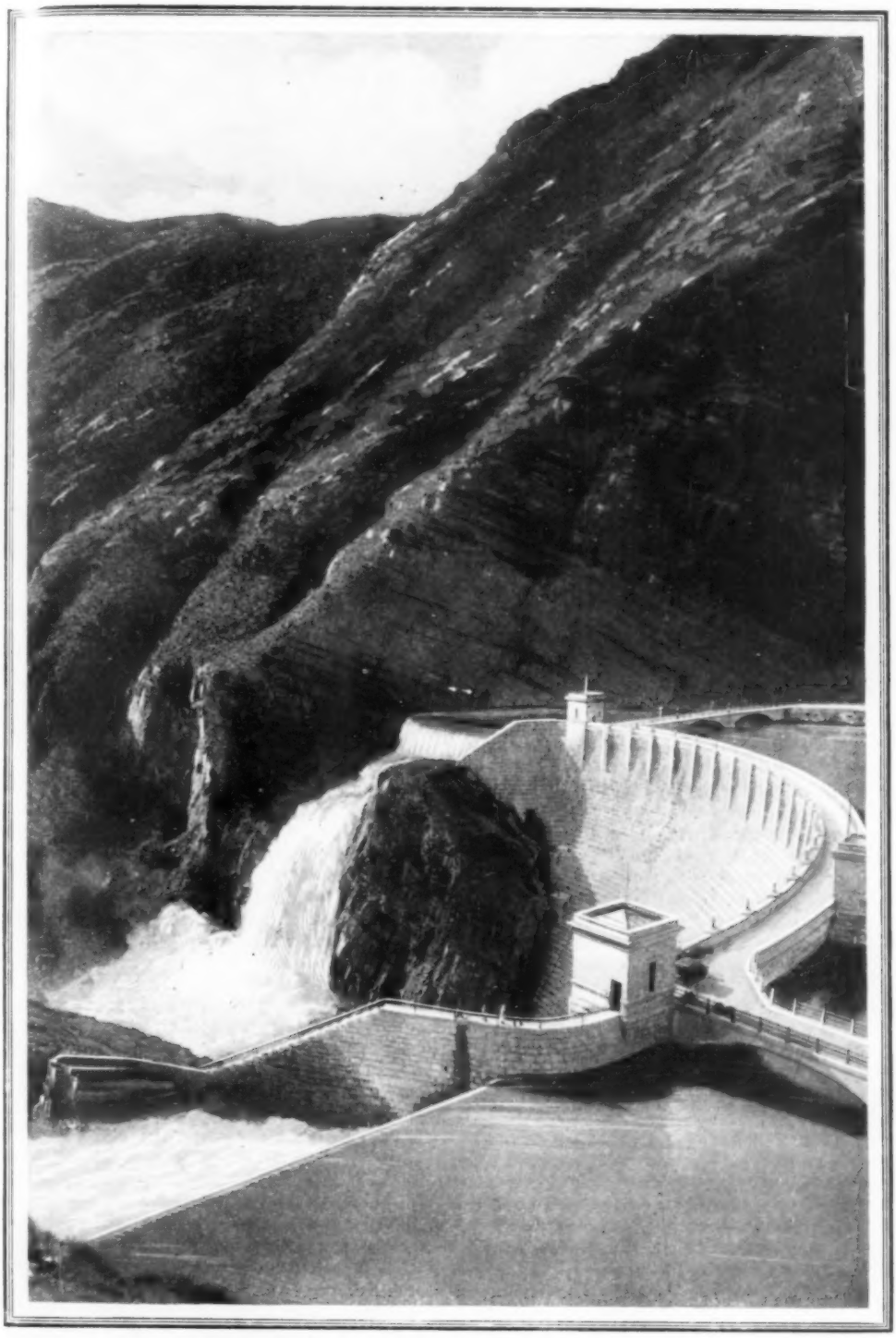
By H. E. BYRAM
President, Chicago, Milwaukee and St. Paul Railway

AS the "Iron Horse" displaced the "Pony Express," so the new "King of the Rails"—the electric locomotive, drawing its white coal from the trolley wire suspended overhead—has sounded the death knell of the steam railroad engine wherever electricity is available.

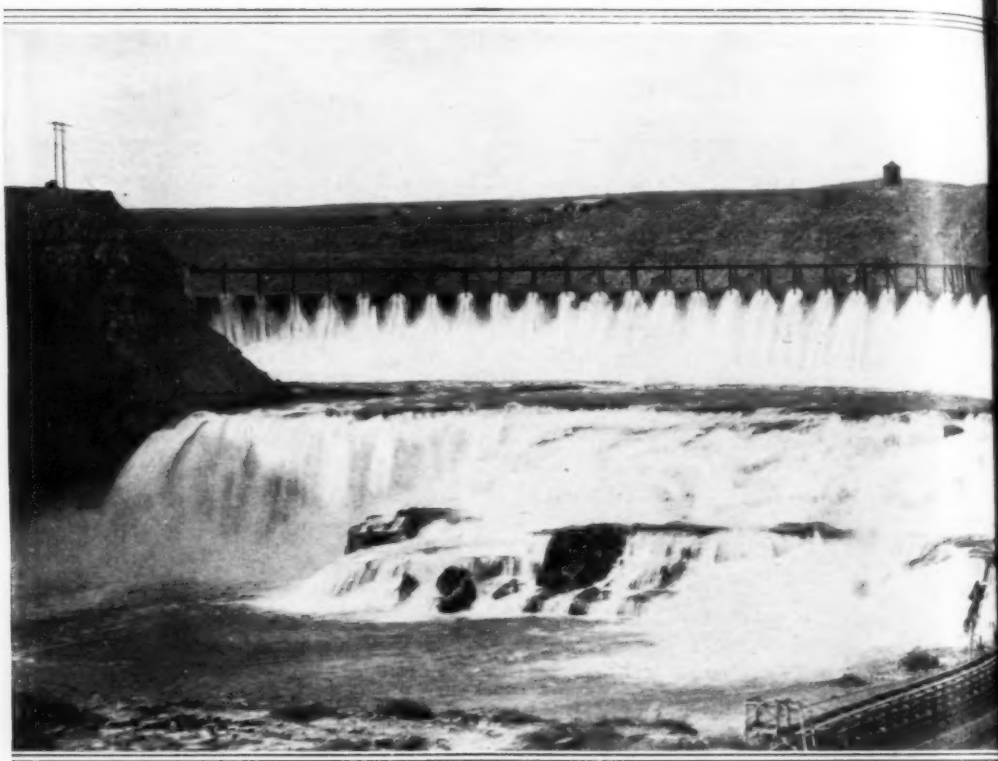
In a single year, on two divisions of our road alone, forty-four electrics displaced 121 steam locomotives and moved the transcontinental traffic at a cost for power of $672,000, as compared with the $1,400,000 it would have required for steam. The actual saving was far greater than even these figures indicate, as the cars that once hauled fuel from the mines to the locomotives were released for revenue-paying service; the investment in coal docks and water tanks was eliminated, and that part of the motive power that was once used up in hauling around the engine's fuel and water was released for other purposes.

In the days of steam operation on our mountain divisions the average size of all trains was somewhat less than 1,600 tons. Today, with our motive power cut to one-third, a mile-long freight train of 110 cars, with a total weight of 5,000 tons or better, is not the exception but the rule, while the average of all trains, passenger, freight, work and locomotives traveling "light" over the road, is around 3,000 tons.

Ten years ago it was not uncommon to see three steam locomotives toiling up the hills toward the continental divide, dragging the twelve or thirteen cars of the westward-bound Olympian flyer. Ahead labored a Pacific-type engine, one of the monarchs of the road, and behind two helpers assisted in pushing the 1,500 ton train along at a fifteen-mile-an-hour gait.



Between Canyon Walls, High Cement Barriers Such as This, the Roosevelt Dam in Arizona Which Stores 42,000,000,000 Gallons of Water for Irrigation, Are Being Built for Power



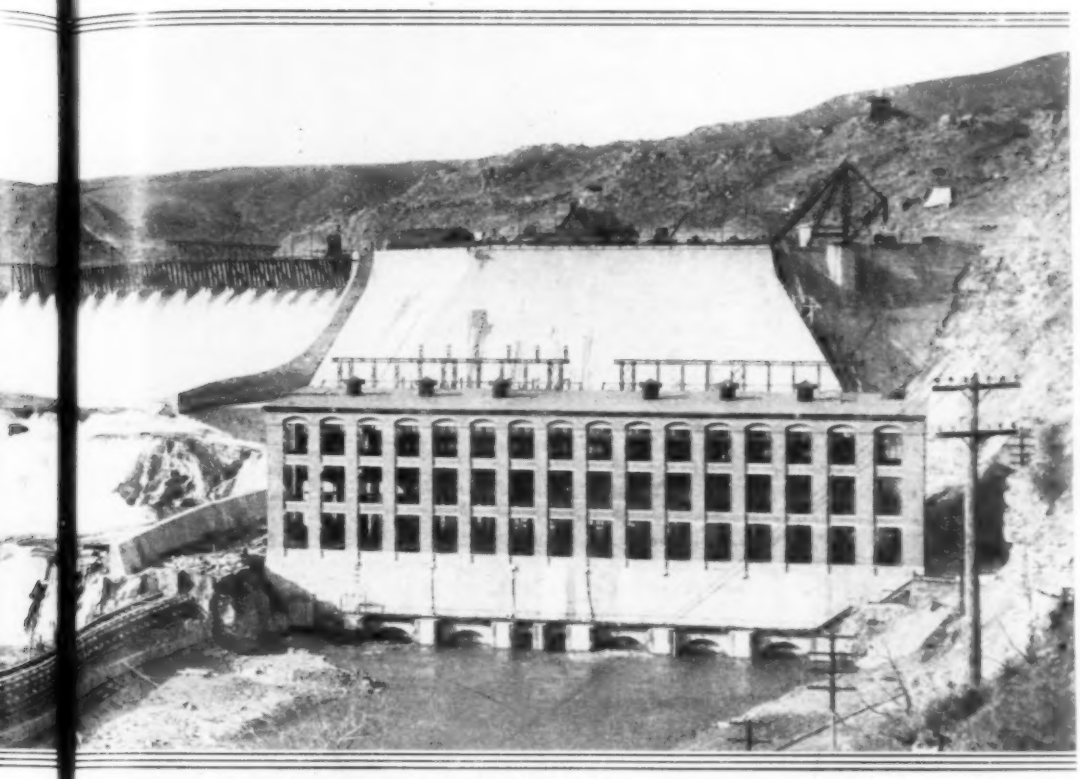
Part of the Dam and Spillway near Great Falls, Mont., Where the Missouri River Has Been Harnessed to Provide Power for Running Railway Locomotives and Mining Machinery

Today, the scene has changed. An electric locomotive purrs out of the east and pauses a moment at Three Forks, Mont., where the waters of the Jefferson, Madison and Gallatin rivers unite to form the Missouri, which winds its way 2,551 miles to the Mississippi. Along its banks, the falling waters, stored behind enormous dams, are turning the turbines of many power houses, converting the snows and the rain into power that feeds, through the trolley wire above, the big electric locomotive. A brief pause, and the long train of brilliantly lighted cars slips away into the west as silently as it came. There is no noise, no smoke; no spinning of mighty drivewheels; no clanking of drawbars nor backing to take up the slack. In the sleepers passengers are first aware that the train is under way when they look up to find the station lights gliding past.

Away on the flat up the Jefferson valley, the train gathers speed. Its single electric locomotive, which has replaced the three engines of older days, drones contentedly along. In the operator's cab the indicator of the speedometer climbs higher—forty miles, forty-five, fifty, sixty, and then sixty-five. There is a world of power yet uncalled for, but the engineer, in obedience to strict operating rules, checks the train there.

The lights of Piedmont, thirty-four and a half miles west of the headwaters of the Missouri, flash past, and the engineer eases his throttle back, while the hum of the motors rises to the drone of a lazy bee as the long climb to the roof of North America begins. The grade shifts from one per cent to one and one-half, then one and seven-tenths, and finally two per cent, which means a climb of 105 and six-tenths feet to the mile. The engineer checks his speed to twenty-five miles on the sharper curves, with thirty-five on the stretches and forty up the straightaways. Twenty-five or thirty-five or forty, it is all the same to the big electric with its inexhaustible supply of white coal feeding silently down from the wires above.

On the instrument board, the ammeters register a load of 200 amperes and the voltmeters show a working power of 3,000 volts. The bright, white light of Vendome block signal bores through the night the message of a clear track ahead for the



Where the River Actually Starts Its Service, the Big Power House at Great Falls, Sheltering Six Generating Units of 10,000 Kilowatts' Capacity Each

three and seven-tenths mile climb to Cedric, 361 feet above.

To the steady click of drivewheels on steel rails another climb of 486 feet to Grace slips by, four and nine-tenths miles negotiated in ten minutes. Ahead looms the crest of the divide, bathed in the final glow of the sun, which set for folks below some three hours before. A climb of 658 feet in a distance of only six and a half miles, and the flyer glides into the tunnel on the pass. Then the lights of Butte are in view and the train starts downgrade. The engineer does not touch his brake valve. Instead he shuts off the power, pulls a lever, and then, apparently, turns the power on again.

What he has actually done is start the regenerative motors, one of the most remarkable inventions in all railroad history. When he shut off the power and pulled another switch lever he changed the entire character of the big motors which drove the train up the hill. By that act he passed a powerful current through the fields of the motors—overexcited them, the electricians say. As the train gained momentum down the mountainside, the motor armatures, which had turned the huge drivewheels coming up, were themselves turned by the drivers and actually began to manufacture electricity and return it to the trolley wire overhead. This also serves as a brake, and regulates the speed of the train. If a ten-car train starts down the mountain and a six-car train at the same moment starts up, the down-bound train would pull the other up the hill without any expense to the railroad for power. The power generated is not the only saving going downhill. Equally important is the absence of wear on brakes, wheels, rails, and on the cars.

The present electrical system embraces two sections, one of 440 miles from Harlowton, Mont., to Avery, Idaho, and another of 209 miles between Othello and Tacoma, Wash. Included in those two stretches are our three main mountain divisions, over the Rockies, Bitterroots and Cascades. As soon as possible the gap from Avery to Othello will be closed, while power-transmission lines are already available to extend the system much farther across the plains states west of the Mississippi.

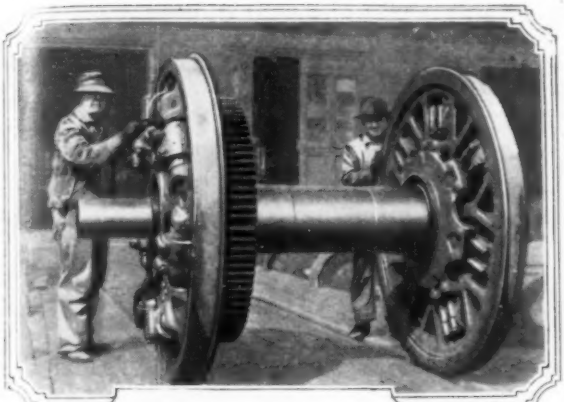
Some idea of the first cost may be gained from the amount of copper used in transmission wires and locomotives. We have 22,682,000 pounds of copper in the entire electrical system, an average of seventeen and four-tenths tons per mile. On our fifteen passenger, forty-two freight and four electric engines we have 1,872,000 pounds of copper, while the trolley wire alone weighs 14,892,000 pounds. The rest of the copper is used in substations, transformers and transmission wires. The railroad does not manufacture any power, but buys its current from private corporations.

Our electric motors are of three types—heavy-duty geared freight locomotives, lighter geared passenger engines on the eastern section and bipolar gearless motors for passenger trains on the coast division. The big freight engines—the giants of the road—are 112 feet long, with a wheelbase of 102 feet eight inches. They are so big, in fact, that they are built up of two units, either one of which may be operated independently. These engines have a speed of fifteen to twenty-five miles an hour, with their low-gear ratio, and develop 3,440 horsepower. They are propelled by eight motors, turning their sixteen fifty-two inch drivewheels, and have a total weight of 576,000 pounds. The geared passenger motors on the Rocky mountain and Missoula divisions have a weight almost as great—566,780 pounds. Besides the enormous weight of these engines, they carry 3,000 pounds of sand, for the track; 6,000 pounds of oil, to run the hot-water heater which supplies the coaches and sleeping cars, and 28,500 pounds of water for the heater.

The third, and newest type of engine, the bipolar gearless, in use on the coast, looks more like its steam rival than the others, or rather like two steam engines back to back. It has double operating cabs in the center and boiler-shaped housings at either end for the electrical machinery. The bipolars are also unique because of their gearless principle, the armatures of the motors being part of the drivewheel axles. With twelve of these motors operating their forty-four inch drivewheels they develop 3,500 horsepower.

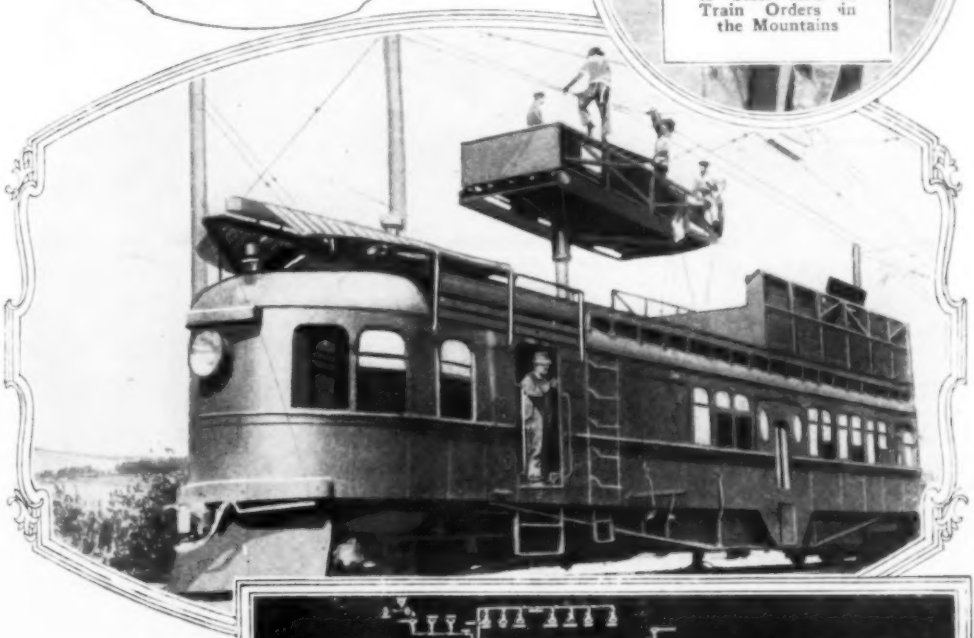
These three types all use pantograph trolleys, while the trolley wire is made up of copper strands wound about a hemp core, the larger surface area of this type carrying more current with less loss than a single solid wire, while it is much more flexible and less likely to break in high winds or when loaded with ice and sleet.

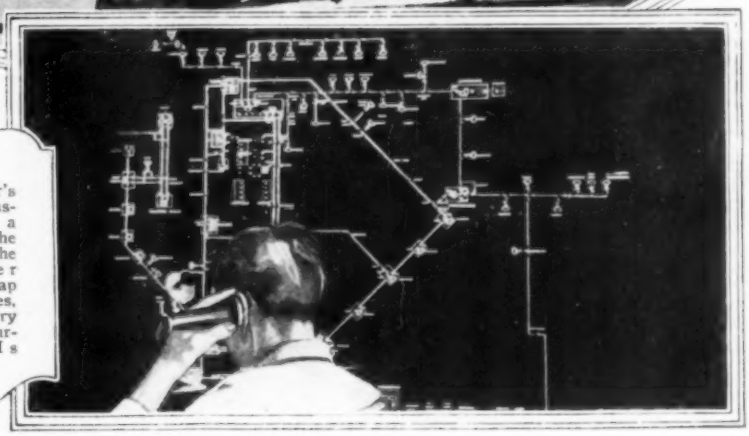
Controls of an Electric Motor, with Throttle at Left, Speed Recorder, and, at Right, Two Ammeters and Two Pressure Gauges for the Air-Brake System



Pair of Electric-Locomotive Wheels with Quill Spring Drive and Huge Gear

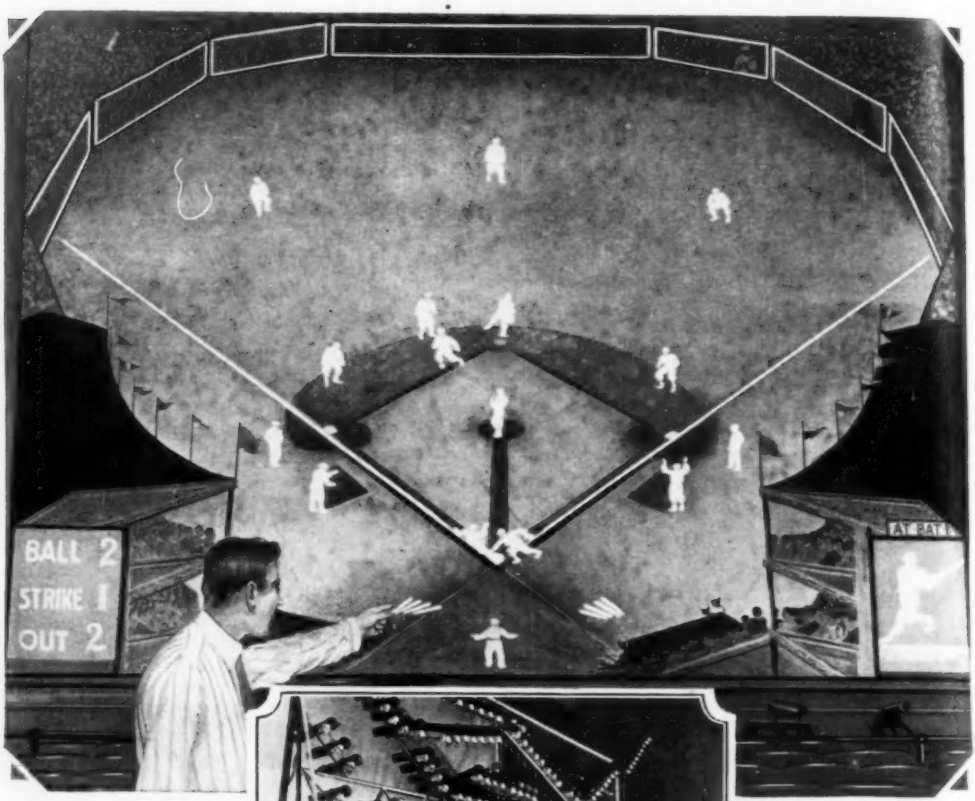
A Steel Rod Is Train Orders in the Mountains

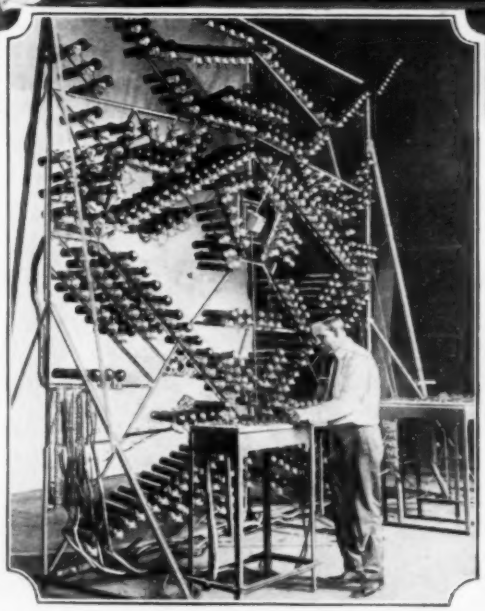




The Trouble Shooter's Car (Above) Has Gas-Electric Drive and a Hydraulic Lift for the Working Platform; the Power Dispatcher (Right), with His Map of 4,000 Miles of Lines, and a Light for Every Switch, Sends the Current Where It Is Needed

EVERY MOVE IN BALL GAME IS SHOWN ON SCREEN





Copyright, Henry Miller

Realistic Baseball Diamond on Screen, and behind Scenes Showing Network of Bulbs

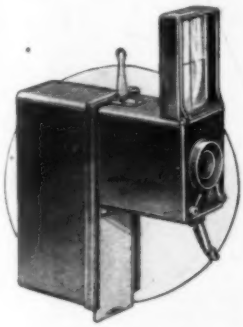
Play by play, practically every movement made in a baseball game at a distant park is reproduced with realistic accuracy on a thirty-foot screen for the enjoyment of theater patrons with the aid of an ingenious electrical apparatus invented by an eastern man. It is virtually a motion-picture machine without film or projector, the figures being made to move across the screen by a succession of quickly flashing lights which are wired to the telegraph instruments. Without the help of a vocal announcer, witnesses may watch the batter hit the ball or strike out, run bases, slide; see the pitcher "wind up" and curve the ball, and are able to tell if the player is right-handed or a "south paw." The umpire's decisions are announced on squares at the sides, while a background painted to resemble the crowds at an actual game adds to the reality of the scene. The outfit consists of 19,000 feet of wire and 400 electric-light bulbs. The inventor is said to have spent ten years in completing it and it was successfully installed in a theater for recording games played by the home team.

Tea Is Grown by the Ton to Supply Drinkers throughout the World

Mentioned in Chinese legends almost as far back as 3,000 years before Christ, tea for centuries has played an important part in the social, political and commercial history of the world, and today is one of the most valuable articles of trade to certain countries. Approximately 100,000,000 pounds are imported into the United States alone while the total exports of the tea-producing nations are estimated at more than ten times that amount. Tea is now the fourth most important product of the planters of the Dutch East Indies, according to reports of the Netherlands chamber of commerce, nearly 300 plantations there producing, in 1923, 106,260,000 pounds, of which 4,443 tons were sent to the United States.

Photo Revolver "Shoots" Pictures at Pressure on Trigger

Using cut or roll film, a compact camera that weighs less than a pound and can be operated with one hand, has been made in France. It was designed especially for the convenience of bicycle riders, autoists, police and others who wish to make "quick" pictures while "in action." The operator aims through an automatic viewfinder, the exact size of the picture taken. The shutter is pressed by a trigger and the grip holds sufficient roll film for 100 exposures. The instrument is provided with the ordinary distance and lens adjustments and enlarging apparatus is furnished for the pictures, which are about an inch square.



Where Egg Yolks Get Color

That the yolks of hens' eggs are yellow because of the pigments in the foods the fowls eat is shown by an exhibit prepared by Prof. R. H. Plimmer of London at the Wembley exposition. So far as the hen herself is concerned, the professor finds, the yolk would be pure white were it not for the pigment in leaves, vegetables, corn and other colored grains consumed.

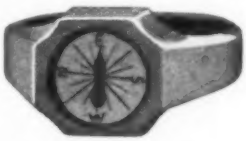
Air-Filter Mask Protects Painters from Lead Poisoning

To protect painters from lead poisoning, a malady commonly suffered in their profession especially when spraying implements are used, a mask which completely covers the mouth and nose and filters the air has been invented. It is connected to the spray gun by a short length of rubber hose and as the painter works the trigger to spray the paint, the movement sends a supply of fresh air to his nostrils through the hose and a moist filtering sponge in the mask. Pressure is regulated and even feeding assured by needle valves. The mask is light, compact and comfortable and is easily put on or removed.

Painter Demonstrating a Lead-Poisoning Preventive, the Air-Filter Mask Connected to Spray Gun

Tiny Compass Set in Ring Helps in Making Electrical Tests

To save time and to prevent loss of the instrument, a small compass has been set in a finger ring. Worn by electricians, it is always convenient for determining the polarity of motors and generators and for testing high-voltage lines. Travelers in strange or uncharted areas may employ it to indicate direction instead of the pocket varieties of the article. The mounting is strongly made of polished metal, and the dial is protected by a heavy glass cover.



A Bit of South Sea Landscape as Background for a Picturesque Setting. All Built in the Movie Studio by Property Wizards' Magic

Head of a Studio-Made Sphinx Being Raised into Position; the Section Weighs 1,500 Pounds and Completes a Five-Ton Figure Copied from Those Found among Ancient Ruins

When the Movie Camera Won't Lie

Wizards of the Studios Aid Realism by Building Everything from Twelve-Ton Sphinxes to Lifelike Imitations of Flies

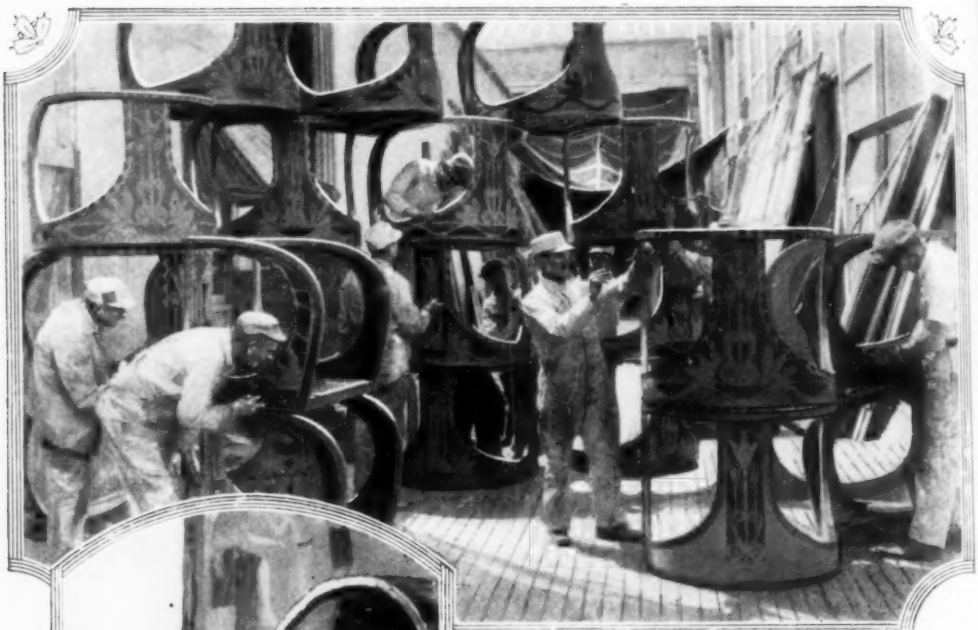
OF all the strange sights to be seen in movieland, the property department is one of the most wonderful. Toys of all kinds hang from the ceilings and walls. Here, a tiny castle, complete in every detail; there, an assortment of ships ranging from sections of ocean liners to submarines—each miniature made by a craftsman expert in his line.

To state that the wizards who manage these shops can make anything, is not so very far out of the way. And when you consider that daily orders from directors run from twelve-ton Sphinxes to hand-carved house flies, you can realize why these men must be skilled in almost every trade and profession.

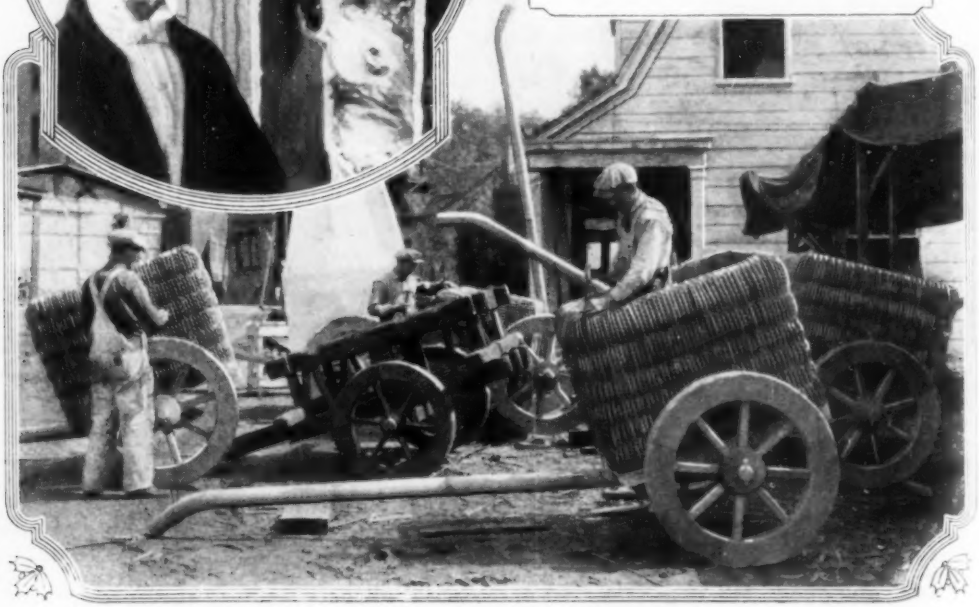
One "prop" wizard has made mechanical ants, bees and other insects. Recently he was called upon to equip a huge live alligator with wings and tusks, thus converting it into a dragon. Again a replica of the electric chair was needed. With only a photograph as a guide, an exact duplicate was made in a few days' time. It wasn't constructed of the same materials, of course, as the original but to the camera it registered exactly the same.

However, many of the articles demanded must be practical to a certain degree. Cannon, for instance, are so made that they can be fired. An oil gusher was needed, so the "prop" man erected a derrick on the outskirts of the town set. A pipe ran from the bottom of the derrick to a spot outside the camera's vision. A fire engine was hitched to the pipe line and at the signal, water which had previously been colored black so that it would photograph like oil, was pumped through the pipe with considerable force. The effect was that of an actual oil gusher.

The plaster shop is another department which employs men at the top of their trade. In making imitation marble a special cement is used, and before it sets, silk



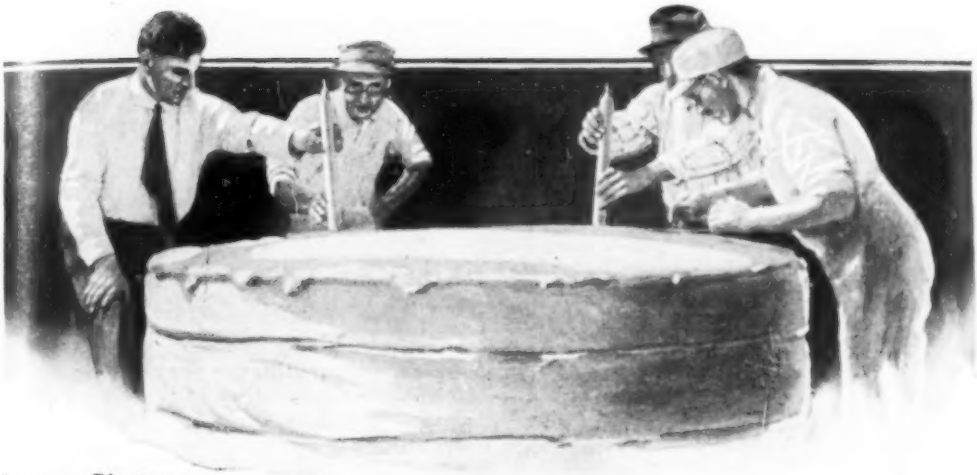
Painters in a Movie Property Room Decorating Part of 250 Egyptian Chariots Constructed in the Studio Shop for a Recent Biblical Spectacle; Left, Screen Star Inspecting a Replica of an Egyptian Mummy Made Solely for Use in a Museum Scene of a Large Production, and Below, Group of "Prop" Oxcarts Patterned after Those That Carried Many of the Children of Israel from Their Captivity and Which Did Service during a Motion-Picture Portrayal of That Event



Assembling Parts of a Gigantic Plaster Statue of One of the Pharaohs of Old Egypt That Occupied a Conspicuous Place in Historical Set

Erecting a Large Oak Tree Modeled in Clay over a Wooden Framework and Transported to Its Position on a Truck

Where the Art of Unseen Property Crew Reproduces the Wonders of a Buried Age; Lower Portions of Thirty-Foot Plaster Figures Compared in Size with One of the Players



Immense Plaster Birthday Cake into Which Edible Portions Were Inserted

threads dyed various colors are drawn through it. This leaves the characteristic marble texture. When a piece of this composition stone is broken the colors can be seen through the entire thickness. Tons of gypsum and bales of fiber are consumed every month. Statuary that would cost thousands of dollars if purchased by the piece is molded every day.

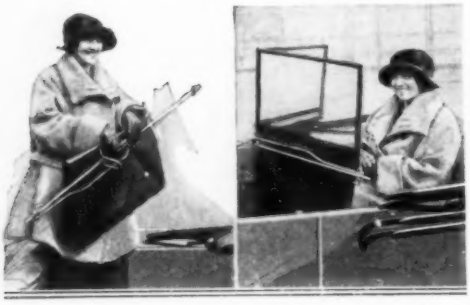
As photoplays must not lie, research departments devote much time to the digging up of necessary data which make pictures true, faithful revelations of the actual life of the characters which people them and a correct representation of the locales of the stories.

Although the property department may receive orders for furniture of an ancient, medieval or modern period to decorate a set, the work does not begin until the research experts have supplied photographs or descriptions.

One of the Familiar Property Chests That Contains Raw Materials from Which Many of the Smaller Stage Pieces Are Formed

Folding Rear Windshield for Auto Gives Touring Comfort

Discomforts that frequently attend riding in the rear seat of an open car are said to be removed by means of a folding windshield which can be attached in a few moments and rolls up within a small space when not in use. The windows are of celluloid, and a long apron below them affords additional protection for the passengers' feet. Braces are clamped to the front seat and hold the shield rigidly in place. The arrangement is V-shaped, to decrease the wind resistance, is durable and cannot get out of order, it is claimed.



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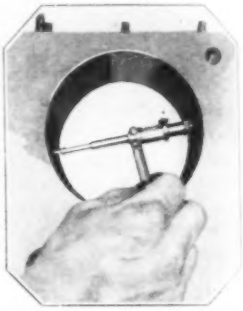
Easily Folded, Useful When Extended, Rear-Seat Windshield Is Open-Car Comfort

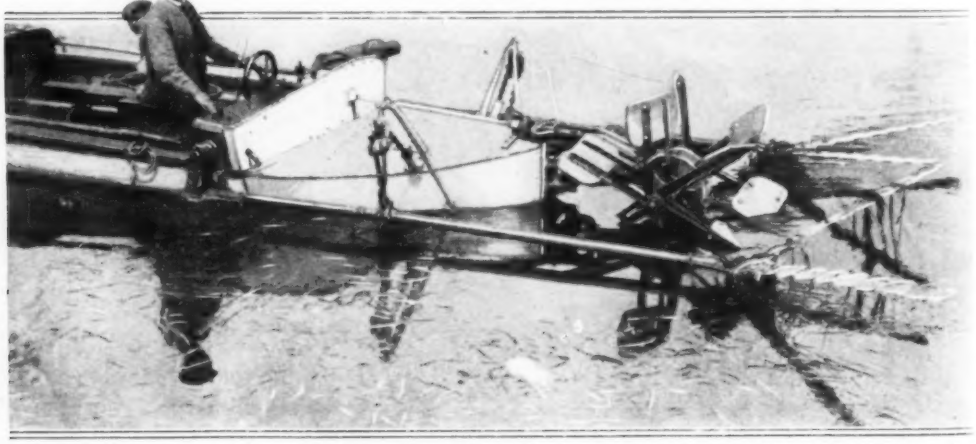
Strange Craft Cuts River Weeds at Depth of Seven Feet

When weeds begin to grow in the Thames river at Oxford, England, caretakers get out their submarine mowing machine, a motorboat equipped with blades in front, and cut the dense growth before it menaces boating and fouls the water. The knife frames are adjusted so that they can be made to cut at a depth of seven feet. The stalks are easily collected from the surface, and those that do not rise sink to the bottom.

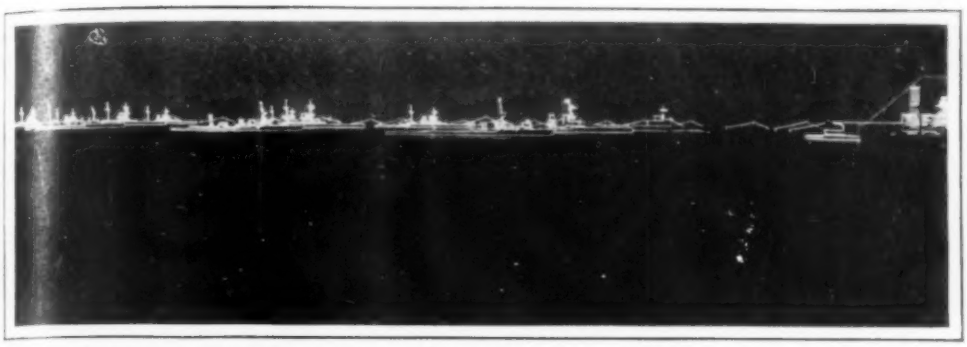
Gauge with Handle and Lock Clamp Simplifies Measuring Holes

Most of the difficulties encountered in determining the inside diameters of holes in cylinder blocks and other machine parts are eliminated with the use of an improved micrometer consisting of a head with one half-inch measuring screw, six rods and a spacing collar now being manufactured. In addition to a convenient hook handle fitting about the body of the tool so that it can be lowered inside holes too small to permit the entrance of the user's hand, it has a clamping device by which the sliding rule part may be locked at any reading. This also prevents turning while the micrometer is in use. Measurements from two to eight inches by thousandths of an inch may be taken. The ends of the rods are hardened and so designed that it is possible to adjust them for wear by loosening a locknut. The handle plug is made of soft brass so it will not mar or injure the tools.





Cutting Weeds in Thames River with Motorboat Mowing Machine Fitted with Adjustable Sickles in Forward Frame That Can Be Lowered to Depth of Seven Feet



Etched against the Sky in Points of Dazzling Lights, Ships of the British Fleet Are Bathed in Luminous Splendor for a Night Review at Naval Pageant

British Fleet Outlined in Lights in First Pageant Since War

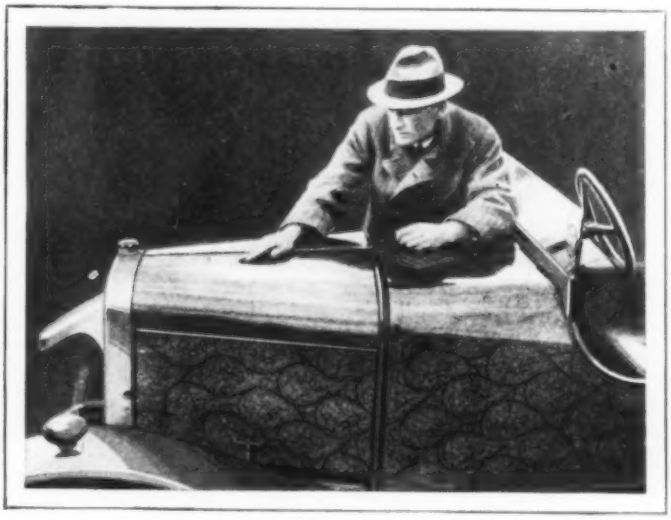
The most brilliant naval spectacle since the days just before the war was staged when the king reviewed the British grand fleet. The vessels had been specially decorated with streams of pennants by day and strings of electrics by night, the lights etching their hulls, masts and rigging in brilliant bands of fire. The review marked the resumption of the great naval pageants, the last of which was held in the closing days of July, 1914.

Many Tasks Done at Trifling Cost by Small Amount of Electricity

What a small sum of money can do when "harnessed" to electricity is well illustrated by a recent report showing the tasks that can be performed by one kilowatt-hour of electrical energy, which in this country costs around ten cents or less depending upon the amount of electricity used. The French government after exhaustive research and experiment discovered that the unit of power will drive a sewing machine for twenty hours, clean fifteen steel tableknives for one year, clip five horses or twenty-five sheep, heat water for shaving for one month, light three cigars a day for five years, heat a flatiron for three hours, boil 2.37 gallons of water, fry fifteen chops in fifteen minutes, heat a curling iron for twenty mornings, incubate 250 eggs, milk twenty cows, separate 350 gallons of milk or churn 440 pounds of butter.

Wallpaper Finish for Auto Bodies Saves Task of Painting

Doing away with the many coats of paint required to cover the body of an automobile, a textile material that can be decorated in almost any wallpaper pattern has been developed by an engineer in England. The sheets can be easily and quickly applied so that they will provide a closely fitted covering composed of scrolled, flowered or similarly figured surfaces. The material has a glossy finish which greatly adds to its appearance and, it is claimed, can be washed and rubbed without marring the effect.



Inventor Inspecting One of His Patterned Designs of the Wallpaper Automobile Finish, Neatly Covering Hood and Body

One of the Special Thermometers That Records Sunshine by Expansion of Lower Black Glass Tube on a Mercury Column between Platinum Contact Points

At Left, an Observer Is Sending Up Balloon Loaded with Recording Instruments That Will Show Velocity and Direction of Wind at Various Altitudes; Right, Inflating and Measuring a Weather Balloon

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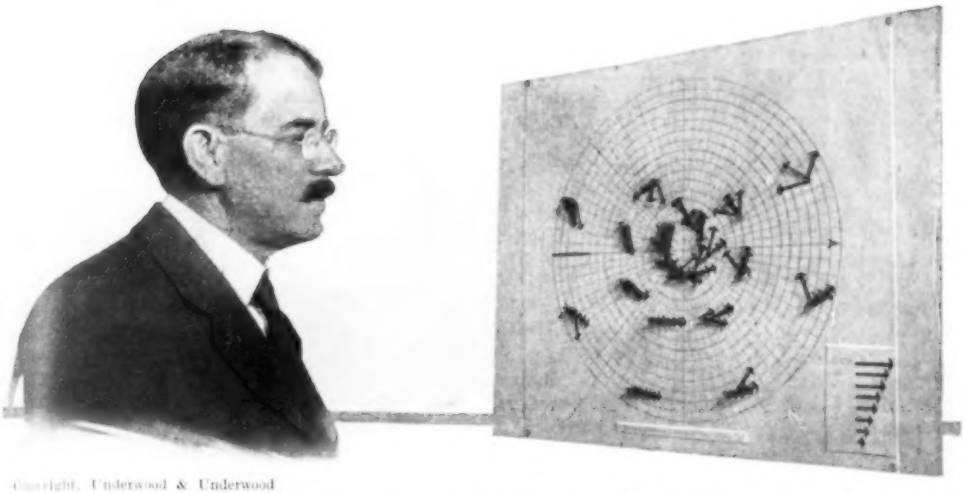
Calculating Wind's Velocity and Direction on Recording Device Connected with Instruments on Top of Building 200 Feet above Street Level; These Data, Minutes of Sunshine Each Day and Rainfall Are Shown on a Revolving Chart; to the Left Is Barometer Which Records Air Pressure on a Card That Revolves Once in Twenty-Four Hours



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Forecaster Examining Chart Which Shows Direction of the Winds at Various Altitudes, during Preparation of Aviation Weather Forecasts Now Being Made for Every Part of the Country

Making the Air Safe for Fliers

Uncle Sam's Charts of the Upper Atmosphere Enable Aviators to Avoid Storms by Flying Over or Around Them

FORECASTING weather for the air mail, army and navy fliers and civilian aviators has added a new science to the business of the department of agriculture's weather bureau. Aerological observation charts are as much in demand as the predictions of heat and cold and fair or stormy weather for business men on the ground. The importance of the aerial weather observations is due to the fact that the earth's atmosphere is a series of layers of contrary winds, which may completely "box the compass" within an altitude of a mile or two. The aviator's weather chart shows the direction and velocity of the wind on the surface and at 250, 500, 1,000, 1,500, 2,000, 3,000 and 4,000 meters. On one day recently the chart showed, for example, a gentle north wind blowing four miles an hour at Madison, Wis. For the flier going south, toward St. Louis or Memphis, Tenn., that would appear a favorable breeze, since he would have it behind his back, to help push the plane along.

But go up to 1,000 meters—a favorite flying altitude—and instead of that gentle four-mile breeze out of the north there is a gusty twenty-mile wind out of slightly north of east, ready to send a south-bound plane drifting far out of its course, unless proper allowance is made. Go up another 500 meters and the wind has fallen to nine miles an hour, but shifted to northeast. At 2,000 meters, if the flier had gone on up in search of a better wind, the breeze had shifted around to northwest, and was blowing at thirteen miles an hour. At 3,000 meters it was still out of the northwest, but was blowing twenty-two miles, while at 4,000 meters the aviator would have encountered a half gale blowing from due west at twenty-seven miles an hour.

In forecasting weather for fliers the weather bureau uses not only all the information usually gathered for other forecasts, but sends up captive balloons and box kites bearing recording apparatus to get the wind velocity and direction at various altitudes. Kites are sent up daily at Broken Arrow, Okla., Drexel, Nebr., Due West, S. C., Ellendale, N. D., Groesbeck, Tex., Royal Center, Ind., and kites or balloons twice a day at Burlington, Vt., Denver, Colo., Ithaca, N. Y., Key West, Fla., Lansing, Mich., Madison, Wis., San Juan, Porto Rico, Washington, D. C., and Scott Field, Ill.

The readings of the recording instruments are telegraphed to Washington, Chicago and San Francisco, where aerological maps and flying forecasts are made for fourteen flying zones. To save space, the observations are telegraphed in code.

As soon as a telegram arrives, it is rushed to the forecaster, who decodes it and draws in the directional arrows and marks the velocity on the sheet of aerological maps, one map for the surface and each altitude given.

A sample code telegram from the observer at Drexel, Nebr., on a recent date said: "DREXEL HOPBACK FACETY FOLEY FIXING FEEBLE NILES ROVING SABER SEABORNE TUMULOUS SADDUCER CIRRUM SEVEN." Decoded, "Drexel" and "hopback" give the place and date and each of the next eight words the velocity and direction of the wind on the surface and at 250, 500, 1,000, 1,500, 2,000, 3,000 and 4,000 meters. The word "tumulous" shows the kite reached an extreme altitude of 5,000 meters—1,000 above the highest shown on the usual maps—and "sadducer" means that it encountered a forty-four mile northwest wind blowing there, while "cirrum" means there were a few cumulus clouds in the west, and "seven" gives the visibility in miles. The wind conditions at Drexel on this day were unusual. "Facety" means an eleven-mile east wind was blowing on the surface, while at 250 meters "foley" shows it had shifted to slightly south of east without changing its velocity. At 500 meters "fixing" indicated the same direction, but a velocity of thirteen miles an hour, while "feeble" shows that at 1,000 meters it had shifted to north of east and dropped to nine miles. The next word, "niles," hides a complete boxing of the compass, with the wind circling around to west-southwest, but keeping the same velocity of nine miles an hour, at an altitude of 1,500 meters. At 2,000 meters, "roving" shows a shift to west-northwest, with a velocity of thirteen miles again. From there up a gale began to appear. At 3,000 meters "saber" indicates a north-northwest wind blowing thirty-one miles an hour, while "seaborne" shows a forty-mile gale from the same direction at 4,000 meters. Besides the captive balloons and kites, which carry instruments aloft, the weather bureau also uses small free balloons to show the direction of the wind at various altitudes and the height of the clouds. The diameter of the balloons is carefully measured as they are filled, and their lifting power weighed on delicate scales. Delicate recording instruments also keep continual check on the wind velocity and direction at the surface, and on the sunshine and rain, and the pressure of the atmosphere. When the weather bureau announces that so many hours and minutes of sunshine have been recorded during the day, it is only giving out the facts which have been automatically marked down by one of the most delicate of its apparatus.

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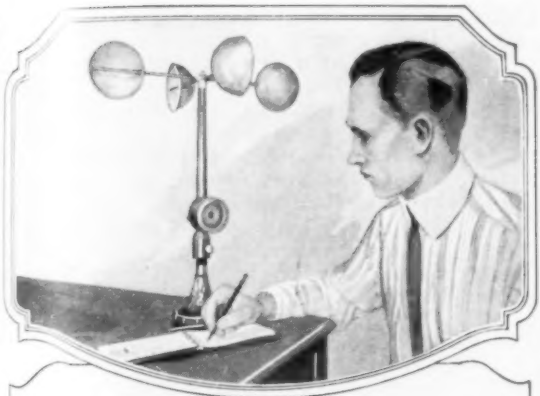
Observers at Washington About to Release a Scout Balloon to Determine Direction and How Fast Wind Blows as Forecast Data for Guidance of Fliers throughout the Country



Five Hundred Revolutions of the Cups on This Instrument Indicate That a "Mile of Wind" Has Passed; the Turns Are Registered on Time Dial Showing Velocity; at Right the Lifting Power of an Observation Balloon Is Being Measured before the Ascent

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Temperatures in the Altitude Chamber Are Measured Outside through Thermo-electric Couples

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Measuring the Water and Air Flow of an Airplane Engine in an Altitude Chamber Which Duplicates Some of the Actual Flying Conditions at Different Heights, to Determine How the Motor Withstands Cold and Density at Varying Levels and to Detect Faults; Controls Are Seen at Right

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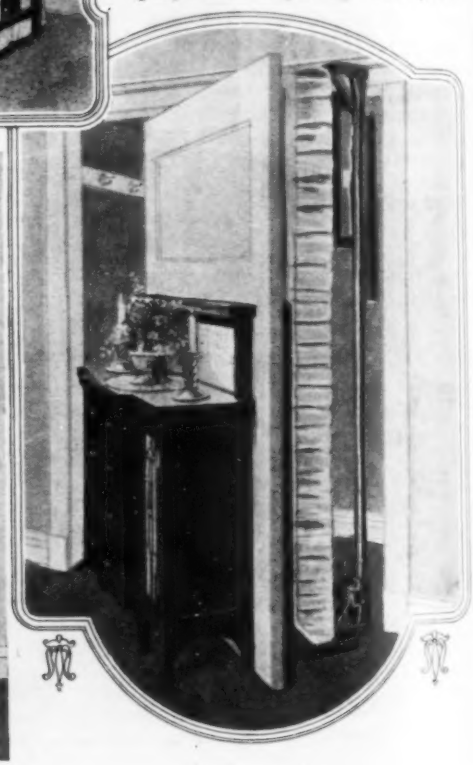
Vanishing Furniture Fixed on Door Doubles the Use of Rooms

Single rooms can be made to serve the purposes of two with a cleverly designed revolving-door arrangement which has a folding bed on one side and a writing table, desk or sideboard on the other. On the back, it opens into a convenient storage closet or dressing room where the side not wanted is concealed. Unlike most folding beds, this one has standard-shaped ends and when let down, cannot be told from one of ordinary pattern, thus removing a common objection to folding furniture. The door is attractively paneled or may be finished in any style to suit the other decorations, is securely pivoted and can be turned with little effort. Houses, apartments and hotels furnished with this equipment need fewer rooms, the advantages of the "best" room in the house can be enjoyed both by day and night and the arrangement effects a great saving in space and reduces construction costs. Door and furniture swing clear of the carpet, opening and closing easily and without noise.

Bed and Sideboard Exposed and Door Swung Part Way Around to Show Storage Closet



Steel Walls to Stop Locusts

Thirty-nine thousand tons of galvanized steel sheets are to be used to stop the crop ravages of locusts in northern Argentina. A $5,000,000 contract for the material has been signed with an American firm. Digging pitfalls, spraying the ground in which the eggs are deposited with chemicals and destroying the egg cases are other ways that have been employed in fighting the pests.

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Loaded on Three Big Barges, the Schoolhouse Gets under Way for Its Seventeen-Mile Voyage through Canal and a Lock Drop of Eighteen Feet

Schoolhouse Rides on Canal Barges for Seventeen-Mile Voyage

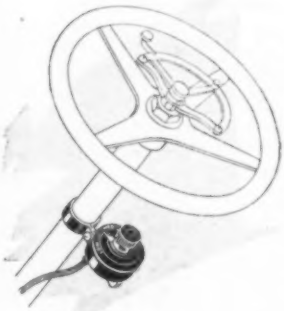
Confronted with the task of moving a large schoolhouse near Lake Washington, not long ago, engineers solved the problem by placing the building on three huge barges and floating it within a short distance of the new site, seventeen miles away. Part of the voyage led through a canal at Seattle, Wash., and it was necessary to lower the massive load through locks from the lake, which is eighteen feet above the level of Puget Sound. Save for a few minor breakages in the stucco, the building suffered little damage.

Power of Two Handfuls of Coal Enough to Last Family a Day

Electrical generating apparatus has been developed to such a high point of efficiency that enough electricity to supply the average household for a whole day can be obtained at the big central power stations from only two handfuls of coal, according to J. F. Johnson, an engineer for a large manufacturing company. He asserts that this is chiefly due to improvements made in the steam-turbine generators, that now commonly average from 20,000 to 35,000 kilowatts and are capable of furnishing a kilowatt for every pound of coal burned. Thirty-five of these big turbines are being assembled by one plant in the east. They are taken as a good indication of the enormous electrical development that has occurred in this country in recent years.

Auto's Lights Turned Up or Down by Knob on Steering Wheel

So that automobile headlights can be adjusted quickly to fit any condition without a sudden shift from one extreme to the other, a device designed for attachment to the steering wheel has been invented. A turn of the dial changes the lamps to any degree of dimness necessary, eliminating the momentary blindness that follows an abrupt switch from a bright glare to semidarkness when passing machines at night, and lessening the danger of a collision or running off the road. Easily attached to any car, the control can also be used for parking lights.



Brush Handle Fits Hose and Sprays Water for Washing Auto

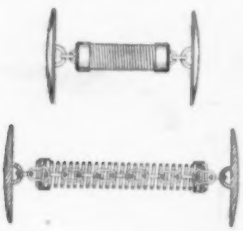
With a long hollow handle to which a garden hose can be attached, a brush holder that sprays water from a nozzle is

Brush Holder and Spray Which Gets Water Supply through Hollow Handle Attached to Garden Hose

being made for washing automobiles, walls, windows and other large surfaces. The brushes are removable so that either soft or stiff bristles can be fastened to the device. The spray is arranged to aid in dislodging dirt, and the water may be turned on with almost any degree of force needed. The great length of the holder enables the user to keep a sufficient distance from the work to avoid being splashed while manipulating the brush.

Expanding Cuff Links Save Trouble in Rolling Up Sleeves

Inconvenience of having to remove the cuff links or unfasten them before rolling up the sleeves, has been eliminated by an expanding link now on the market. The two sides are held together by a series of coil springs which stretch sufficiently to allow the sleeve to be pushed a considerable distance up the arm without having to unfasten the cuffs or take off the coat. The links are easily inserted and are attractive.



Fortune in Diamonds Found on Farm Bought for One Hundred Dollars

Chance discovery of diamond-bearing soil on a farm near Zeekoefontein on the Vaal river in South Africa, precipitated a rush of nearly 3,000 persons, including experienced diggers, students, clerks and even girls, when the government opened the surrounding territory to "claim peggers." Holders of licenses which permitted them to file on the land, formed in a line behind the mining commissioner and a squad of mounted police. At a signal, they rushed forward down a path that had been cleared to the site of the deposits and hastily drove their pegs. The farmer had obtained the land for less than $100 and it yielded him over $10,000 a week. The largest diamond he had discovered weighed thirty-four and one-eighth carats.

Revolving Sign Covers Water Tank and Advertises Theater

Space on an exposed water tank is to be effectively used by a mid-west theater owner for an advertising device to call attention to the building by day and night and to announce various attractions. A steel wire frame, which will be turned by an electric motor and self-winding clockwork, will entirely surround the tank and revolve around it, bearing in large letters the name of the theater and such other legends as may be displayed from time to time. Powerful searchlights will be mounted on the frame and turn with it. The lofty position of the tank suits it to advertising purposes and the frame serves as an attractive shield to cover its plain and somewhat unsightly proportions.

¶Between 7,000 and 8,000 deaths by drowning are recorded every year in the United States.

Tense Moments during Yacht Race with the Crew Crouching on Deck to Avoid the Swing of the Boom as the Craft Comes About on the Turn in a High Wind

Yacht Modeling Teaches Seamanship

Construction and Sailing of Miniature Craft Train Scholars for Contests of Skill with Tools and Boats

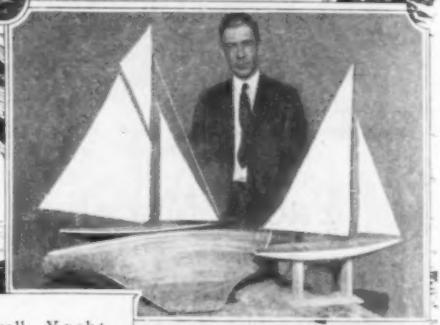
IN an effort to convert youthful landlubbers into potential seamen with a knowledge of the duties and requirements of a thoroughly trained sailor, a model-yacht club of Washington, D. C., is instructing the boys of that community in the building of toy boats and aiding them in the proper sailing of the miniature craft.

When laying out and constructing the models, great attention is paid to the detail of keels, buoyancy and minimum resistance to water. Sails are cut and fitted according to the rules that apply to large craft. Efforts are also made to gain speed for the toy vessels by experimenting with changes in the forming of hulls, and when launched in a pond or tank, the boats' performances are studied so that any new features that might disclose themselves while the model is afloat can be corrected or enlarged upon in order to produce the greatest degree of ability when the designer finally completes the miniature and submits it to the instructors or judges for inspection. Much has been done also by an organization of yachtsmen who are giving assistance to schoolboys and others interested in the building of models as a pastime, or who have taken up the practice as an aid to the study of marine architecture and construction. Experts in the art of model building assist the craftsmen by suggestions regarding tools required and methods of doing the cutting and carving of the hulls, masts and tiny beams. When the modelers are ready to try out the boats, instruction is given them in the handling of sails, which must be set so they will carry the vessels along the courses without causing them to capsize or change direction of travel from the line desired.

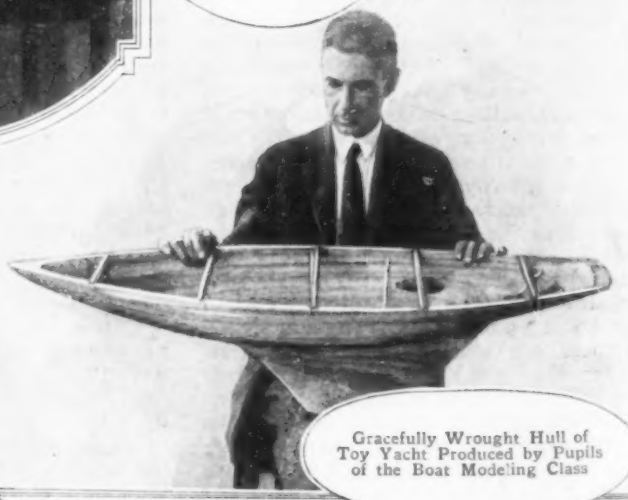
Pupils have been recruited from the ranks of both old and young model enthusiasts. Classes are regularly held for instruction in management of sailing boats by those through whose efforts building of model yachts has been introduced into the schools, for the purpose of giving the students interested in carpentry and woodworking a knowledge of lumber and tools

Fleet as the Wind That Propels Them; Two Yachts Contesting for the Lead during a Race of International Interest Where Superiority Depends on the "Cut" of the Trim Craft

Prize-Winning Miniature Constructed from Blueprints by Youthful Manual-Training Student



Small Yacht Models Completed by Boy Mechanics, Ready for a Trial Run



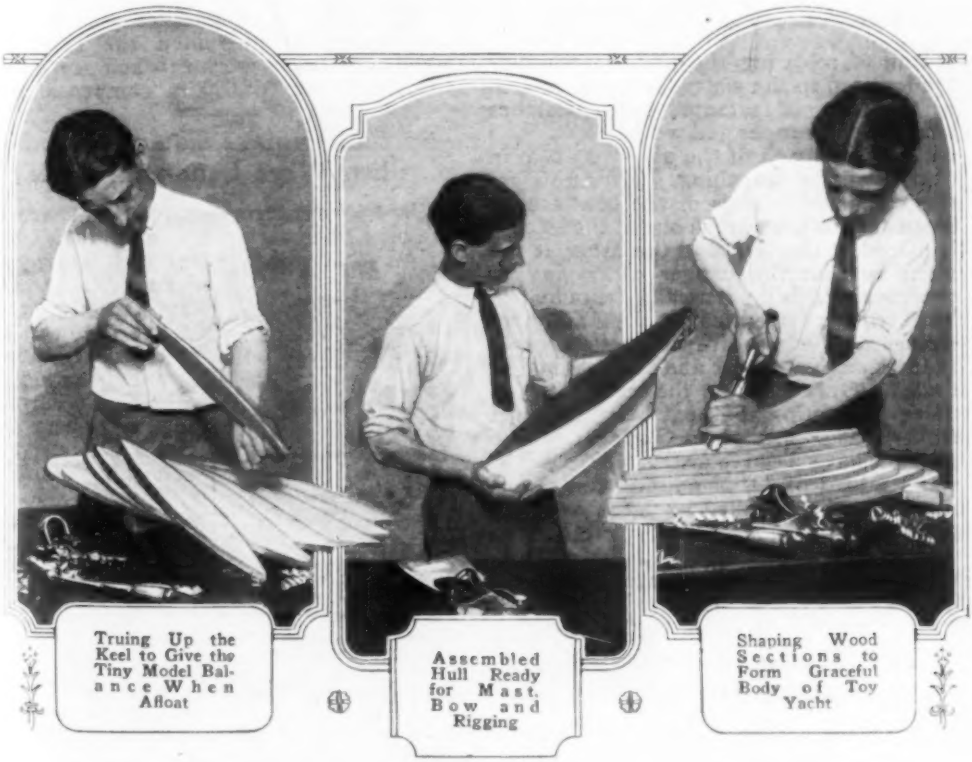
Gracefully Wrought Hull of Toy Yacht Produced by Pupils of the Boat Modeling Class

as applied to the design and construction of sailing craft. Manual-training classes receive the same systematic instruction in the making of toy sailboats as those taught metal working and similar trades.

Together with the knowledge of boat building the scholars get at the hands of special teachers, spare time in home workshops is devoted to the craft. Fairly large models can be completed in this way in from three to four months. Instead of following patterns or copying the work of expert modelers, the students are given blueprints from which to construct their toy vessels. These are prepared by a naval architect who provides the youthful craftsmen with a full set of dimensions, which serves as instruction and practice in the reading of plans.

As a general pattern for the teaching of classes, the architect drew up a design which is the outline of only one-half of a yacht, and this is divided into sections to aid in the progressive steps of the undertaking, including the sail plan for the miniature. From start to finish, each part of the work is inspected by instructors who emphasize the importance of curves and lines in the hulls. Although white pine is preferable for use in the boat models, poplar, because of equally desirable qualities, is substituted when the other material cannot be readily procured.

It is said, after the boys have received a course in the planning and erection of a toy model of a yacht, it is easier to teach them the art of sailing large vessels, for the reason that fitting and handling of sails, important duties of a crew, is taught so the miniatures can be entered in contests held in lagoons of two or three of the city's public parks. These tournaments are arranged by the organizations of yachtsmen and those following the practice of modeling as a hobby or business. Prizes for workmanship and ability to provide speed through the arrangement of sails are offered in addition to trophies for the winners of races. An average of fifteen to twenty models are always under construction in the ordinary manual-training class. The first attempts are always made with simple designs of small size, but with progress on the part of the scholars, larger and more difficult miniatures are submitted to them for construction. Frequently groups of youthful "fans" undertake the making of models together, resulting in quicker work and often superior workmanship.



Truing Up the Keel to Give the Tiny Model Balance When Afloat

Assembled Hull Ready for Mast, Bow and Rigging

Shaping Wood Sections to Form Graceful Body of Toy Yacht

Lever Release in Launching Lifeboat Increases Safety at Sea

As an aid to safety in emergencies at sea, a dependable and easily operated means of releasing the lifeboats as they are lowered to the water has been devised in the form of patented spring catches hooked to the ropes and worked by a lever within easy reach of the officer or man in charge of the launching. With this arrangement, both ends of the boat are let down simultaneously, as one of the catches is placed at the bow and the other at the stern so that the danger of tipping or overturning is practically eliminated. Both trips are operated by chain and wire connections which are inclosed in pipes at the side of the boat and thus cannot be fouled. Only a lift on the lever will pull them, preventing the boat being dropped from the supports by accident. The catches have been constructed to withstand a load of 30,000 pounds, the equipment may be installed on large or small ships and works successfully whether the vessel is moving or still. Similar catches, which may be instantly released, are used for fastening the lifeboats to the decks.

Copyright, National Photo

As It Strikes Flat on the Water, the Lifeboat Is Instantly Released at Both Ends Simultaneously by Tripping the Catches with Lever Seen at Side

Fifteen Thousand Persons Blinded by Industrial Accidents

There are approximately 110,000 blind persons in the United States and 13.5 per cent, or about 15,000 of this number, lost their sight because of industrial accidents, according to a report recently made to the International Association of industrial accidents boards and commissions. As a means of preventing these casualties, the association offered a five-fold code, stressing education, better lighting, eye tests and the use of glasses, prompt and efficient medical service and protection of the eyes with goggles. Three-fourths of the eye injuries suffered by workers were declared to result from preventable causes, while fifteen per cent of industrial accidents were said to result from improper illumination alone. Goggles were especially recommended in chipping operations, riveting, quarrying, blasting and stone cutting. In one of the exhibits shown at the meeting were displayed twenty-six pairs of goggles which had prevented the loss of sight of as many workmen and saved one company over $65,000 in compensations.

Special Airplane Compass Guides Fliers When Landmarks Fade

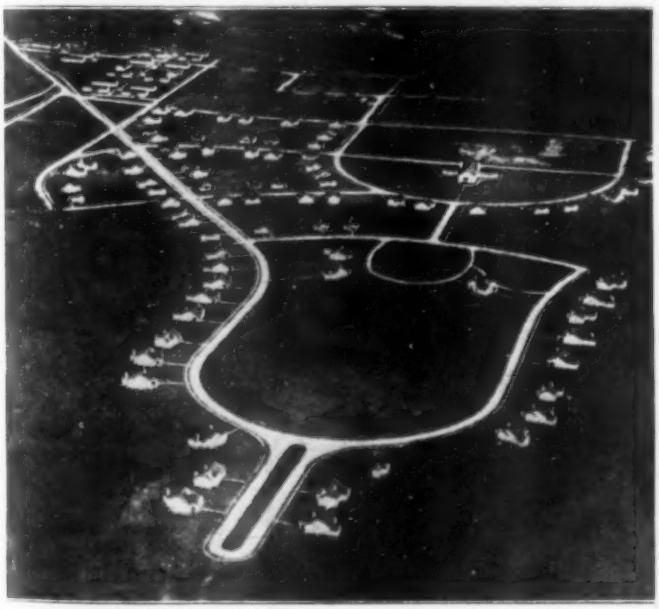
Used for centuries to guide ships across the seas, the mariner's compass has been found to be poorly adapted to flying, because the needle swings too freely when subject to rapid vibration and sudden movement. To correct this, what is known as an earth inductor compass, which works on the same principle as a dynamo, has been invented. It consists, in part, of an armature which is kept steadily revolving on a vertical shaft and a meter on the instrument board before the pilot. The brushes of the armature are set in the direction the airplane is to fly. Any change from this course sets up an electrical current that indicates the deviation on the meter dial.

Wallboard Made of Mixed Minerals Is Proof against Fire and Cold

Claimed to be able to resist fire and sudden changes of temperature to a remarkable degree, a patented wallboard for use on the outside of buildings of all kinds is being manufactured in California. It is only half an inch thick and is composed of a mixture of minerals so combined as to produce a material that effectively insulates against heat and cold. In a chemical-factory fire, not long ago, it sustained the walls until the entire inside of the building had been destroyed.

Village Laid Out in Shape of Bell to Assure Light and Air

Because of its shape a community near Sheffield, Ala., is known as the "Liberty Bell village." The roads winding through the area describe the outlines of a bell and the dwellings are placed in corresponding positions. The center of the plan is almost entirely clear of buildings, while a narrow oval traced by the highway appears to be the hanging link for the top of the design. The town is of modern construction, and each residence is provided with a wide plot of ground to insure to the homes plentiful sunlight and as much air as possible.



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Airplane View of "Liberty Bell Village," Showing the Design Traced by Roads and Streets Which Permits Plenty of Space for Homes

Ancient Treasure Chest Is Found in Wrecking Old Building

Resembling an immense pincushion, a rusted iron safe, about 120 years old, was found in the cellar of one of the oldest

Century-Old Iron Safe, Studded with Rivets, That Was Found in Wrecking Landmark

buildings in Brattleboro, Vt., when it was wrecked recently. Exclusive of the legs, it measured two feet four inches square and was made of thin and narrow strips of iron fastened together with rivets, the size of those used in boilers. Markings inside disclosed that it was built in Providence, R. I., about 1805. The keyholes in both the outer and inner doors indicate that a key of unusual size was used.

Oil Burners Cause Cinder Shortage

Due in part to the great increase in oil burners, a cinder shortage occurred in New York recently, temporarily halting building operations in which millions of dollars had been invested until a regular supply of the material, which is used extensively in fireproofing, could be obtained. A breakdown in the facilities of a cartage company that handles most of the city's ashes was partly to blame for the "famine," but it was revealed that the wide substitution of oil for coal had materially depleted the supply.

Time and Money-Saving Tools

Worn over the Night Clothing, Chamois-Lined Sleeping Robes for Children or Adults Have Draw Cord at the Bottom and Adjustable Hoods, Protecting Head, Feet and Shoulders and Eliminating Heavy Bedding

This Stout Rubber-Tired Baby Cart, Weighing Less than Seven Pounds, Folds Up Flat and Can Be Used Indoors Too

Fitting Closely against Wall When Not in Use, a Collapsible Shoe-Shining Stand Has Holders for Polish, a Hook for Brush and Whiskbroom, and Rag That Works on Rollers; Below, Handy Electric Double Boiler Is Also Suitable for Serving Foods at Table

No Danger of Getting Salt in the Ice Cream with This Rapid Labor-Saving Freezer That Stops Automatically When Contents Are Ready

With Fluid Held in Top Compartment and Released by Pressure on Valve, This Strong-Bristled Brush Thoroughly Cleans Clothing at Home

Anyone wishing further information on devices described in the editorial pages co

for Woman's Workshop in Home

For Cleaning Furniture, Curtains, Walls, Automobiles and Almost Any Part of the House, This Novel Portable Vacuum Cleaner That Connects to a Light Socket Is Practical and Effective

Dressing Table, Shelves and Drawers, and Storage Space for Linen and Other Articles, Are Combined in Handsome, Sanitary Cabinet for the Bathroom

Little Folks Have Fun and Healthful Exercise with a Small Seesaw with Strong Seat and Springs at One End That One Child Operates with Handle; Below Is Can Opener That Cuts Round Holes of Various Sizes in Square or Cylindrical Cans

Gripped Firmly by a Rubber Disk in This Collapsible Holder, Glasses on Trains, Automobiles or Ships Are Kept from Rattling and Breaking

Slippery Milk Bottles of Any Size Are Carried as Easily as Pails with This Simple Collar-and-Chain Arrangement on the Bottle Neck

Auto Motor Heat Shown by Meter on the Instrument Board

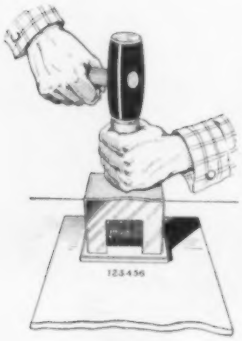
So that the exact condition of the automobile motor may be seen on the instrument board at all times, an electrically

Motor Thermometer on Instrument Board, and Inset Showing Readings

controlled spirit thermometer connected with a thermostat attached to the water-outlet pipe under the hood, has been placed on the market. A graduated scale shows when the engine is too cool, its temperature at the hottest point, when alcohol and water boil, and warns of insufficient oil, idle fan, low water and other causes of overheating in time to prevent damage, it is claimed. It can be quickly and permanently installed on any car, and is said to operate indefinitely without repair.

Metal-Numbering Machine Stamps Serial Figures by Hand

For stamping numbers of several figures at the same time in metal, wood or fiber of all kinds, a small numbering machine that is operated by hand, has been designed. Weighing but four pounds, the device can be easily carried around. It saves time and all impressions are clearly defined and perfectly alined. It is easily placed on the work, a gauge accurately locating the printing position. A blow of a hammer does the rest. The device is securely held on the spot while the impression is being made by a special plate on the bottom. Constructed of steel throughout and with the figure wheels of hardened tool steel, it is strongly built to withstand the hardest usage.



Thirty Thousand Acres of Trees Are Needed Yearly for Toothpicks

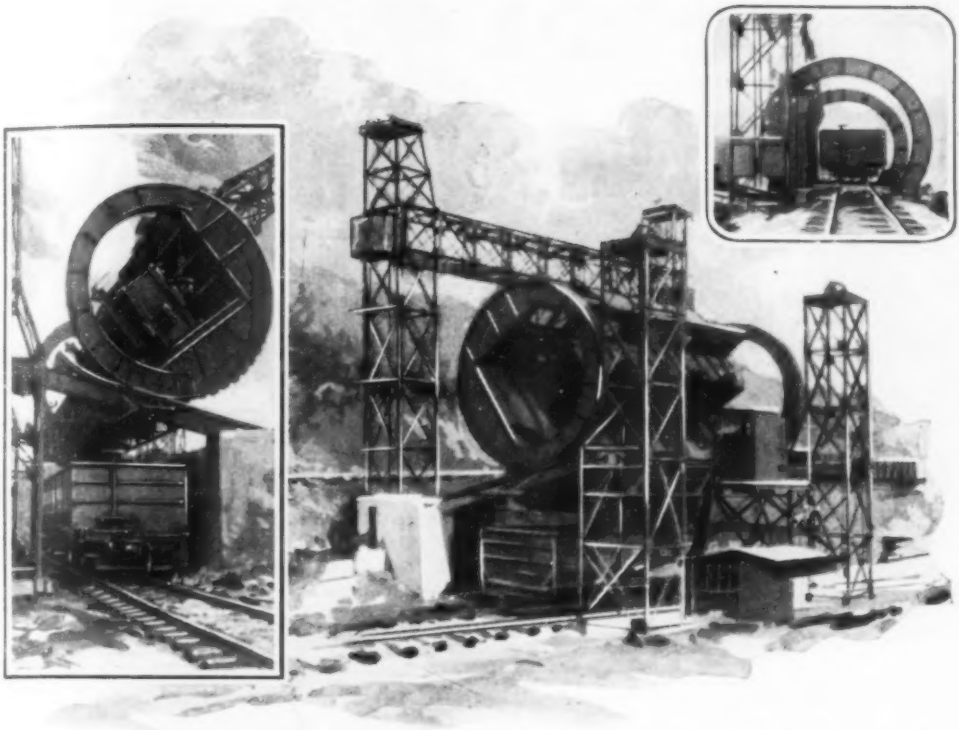
Approximately 30,000 acres of trees are necessary for the manufacture of the toothpicks used yearly in the United States alone, according to government estimates. Maple and hickory are the chief kinds of wood used, although sweet and yellow birch are employed in some localities. After being felled, the logs are sawed into bolts, twenty-eight inches long. These are then steamed and cut into strips of veneer or thin sticks which are divided into ribbons, three inches wide. Eight or ten of these are run through machines that clip them into splinters of regulation toothpick size and shape, and they are then boxed, each container holding about 1,500. Michigan, Maine, Ohio and Oregon are the principal sources of the supply.

Tiny Stone Slab Was Butcher Bill Forty Centuries Ago

What are said to be the oldest and the smallest books in the world are on display at the University Library in Philadelphia.

Two Unique "Books," One of Which Was Written Four Thousand Years Ago

One is a stone tablet, about one and one-half inches square. It was written about 2350 B. C. and contains a brief statement of a butcher's bill for three lambs delivered to the temple of one of the Babylonian kings. The other is as elaborately bound as a more imposing volume and, though smaller than the tablet, contains many closely typed pages.



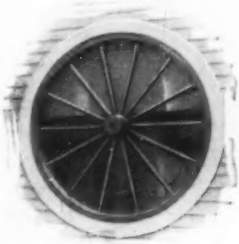
Rolling Tipple Emptying a Narrow-Gauge Coal Car into a Large Gondola; Above, Unloader Returning Its Burden to the Road Level; Left, Beginning Roll Back to Normal Position

Tipple Turns Coal Cars Over, Emptying Twenty an Hour

To transfer coal, lime rock, ore and similar bulky materials from narrow-gauge to standard-built railroad cars, a rolling tipple at Salida, Colo., turns the smaller carriers upside down over the larger ones. The device, which consists of a barrel-shaped iron "cradle," makes a half revolution, permitting its burden to unload the contents in a few seconds. When a hopper is to be emptied, it is run onto a track in the bottom of the tipple which rolls up a short incline as the operator starts the machinery. Heavy weights bring the contrivance back to normal position. Cars of different widths can be handled, since a side-slip arrangement in the track allows any type of gondola to rest against the guides as it begins to turn over. Steel beams that grip and retain the car while it is being rotated operate automatically with its movement. Run by electric power, the unloader is attended by only three men, and it is said that a single operator could manipulate the structure in emergency. Only three to five minutes are consumed for each load, depending on the distance the cars have to travel along the storage tracks. It is estimated that 160 cars can be emptied in an eight-hour day as compared with three under the shovel system formerly used, and they can be returned in much less time to active service without the usual delay in the transfer and unloading yard.

Carriage Wheels as Window Frames Reduce Cost of Building

Utilizing discarded carriage wheels for window frames in a Massachusetts factory is claimed to have resulted in a saving to the owners in the cost of the structure. The heavy spokes are said to give added protection to the panes without obstructing the passage of light and air. Obtained at practically no expense, the wheels give an odd appearance to the building.



Coin-in-Slot Machine Sells Combs That Carry Advertising

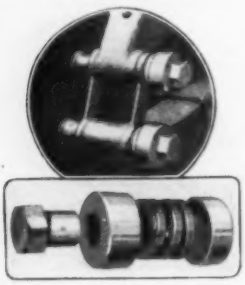
As an aid to busy patrons a penny-in-the-slot vending machine is made to sell

Penny-in-Slot Vending Machine Which Delivers Comb When Penny Is Dropped in Opening

combs in public places. Suitable to install in hotels, railroad stations, theaters and similar gathering points, the device will hold a large supply of the articles. Space is provided at the sides of the combs for the printing of advertising matter or other inscriptions. Small enough to be carried conveniently in pocket or purse, the combs can serve for repeated use.

Grease-Filled Auto Shackle-Bolt Nut Eliminates Squeaky Springs

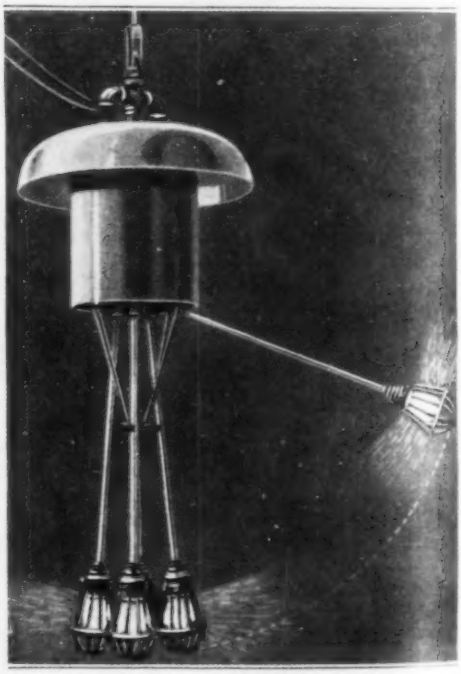
Automobile shackle-bolt nuts, planned to eliminate squeaking and rattling springs and to make frequent tightening unnecessary, are being manufactured by a mid-western company. They consist of two cup-shaped members, telescoping into each other and inclosing a heavy coiled spring, and a nut that fits over the shackle bolt. Before applying, the cups are filled with grease which serves to eliminate noise. By



screwing up the nut, tension is placed on the spring so that the nut cannot become loose, thus preventing the assembly from rattling. The attachments are easily put on, and have nickeled surfaces which add to the appearance of the car.

Traffic Light Gives Fire Alarm and Tells Engines' Route

Combining both a traffic signal and an alarm to warn pedestrians and vehicles of the direction approaching fire apparatus will take, a device for which patents have been asked, can be operated by a push button at the fire station or by a patrolman on the street. As the summons for the fire-fighting crews reach the fire houses, an attendant takes over control of the system by means of a switch. Alarms at affected street intersections may then be put in action, and colored lights started swinging at the corners. At the same time loud gongs attached to the signals call attention to them. The appliance is also made as a fire alarm only.



Traffic Fire Alarm in Operation at Street Crossing Showing Direction Apparatus Is Traveling

When you want anything and do not know where to get it, write Bureau of Information, Popular Mechanics, Chicago.

Broadcasting a "Struggle in the Forest"; Microphone on the Floor Transmits Sounds of Trampled Paper as Rustling of Dead Leaves, and the Striking of Sticks Supplies Beats of Horses' Hoofs

From Stage Thrills to Radio Drama

Behind the Scenes in Studio Where Weird Devices Give Realistic Effects for Unseen Listeners

A SHOT rang out on the still night air, as the old-time fiction writers used to begin their stories. A farmer's family in Maine; a banker in his library in a middle-western city, and a group of cowpunchers in a bunk house in Texas listened breathlessly; for the sound was carried by wireless. Untold thousands of radio fans scattered from the Atlantic to the Pacific and from the Canadian border to the Gulf of Mexico heard it, too, for all of them were tuned in on the drama "Pierre of the Plains," broadcast from an eastern city.

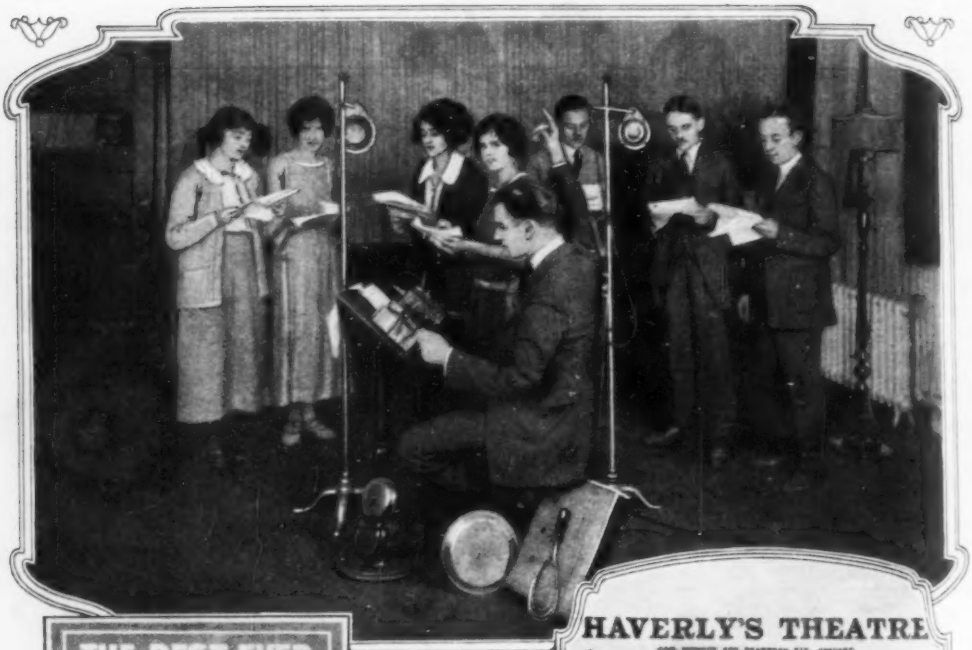
The old-time thriller of the past, that reached its glory when the box office hung out the "S. R. O." sign—standing room only—may have had as many as twelve hundred people hanging breathlessly on the actor's lines, but nowadays when a melodrama is put on the air its invisible audience may run into the millions.

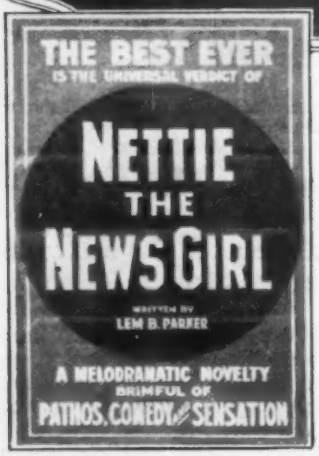
They hear the shot and the heroine's scream. They listen to the galloping hoof beats of the villain's horse as he speeds away; the gasps of the wounded hero as he drags himself to his feet and staggers to his own mount; and the rat-a-tat-tat of flying feet as the animal takes up the pursuit. And they hear the fight of hero and villain among the rustling leaves of the forest.

Equipping a radio-drama outfit with sound-producing devices would drive a regular stage-property man to desperation. Everything from a character's entrance to his exit must be interpreted in a way which will actuate a microphone and carry through the air.

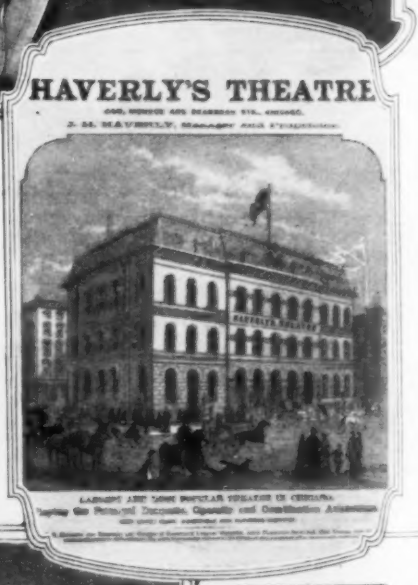
The old-time theatrical producer of "Alaska," "Billy the Kid," "Call of the North," "East Lynne," "For Her Sake," "Her First False Step," "Nettie the Newsgirl," "Ten Nights in a Barroom" or the other melodramas which still are to be seen in the smaller towns and villages, had an easy time compared to the modern radio dramatist.

Think of the difficulty of opening and





In Putting Sound of Dramatic Action into Radio Play, the Director Manipulates Noise - Producing Implements While Characters Follow His Signals with Their Lines; Left, Familiar Type of Theatrical Poster Procured from Stocks Always on Hand in Printeries That Produce "Paper" for More Popular Melodramas



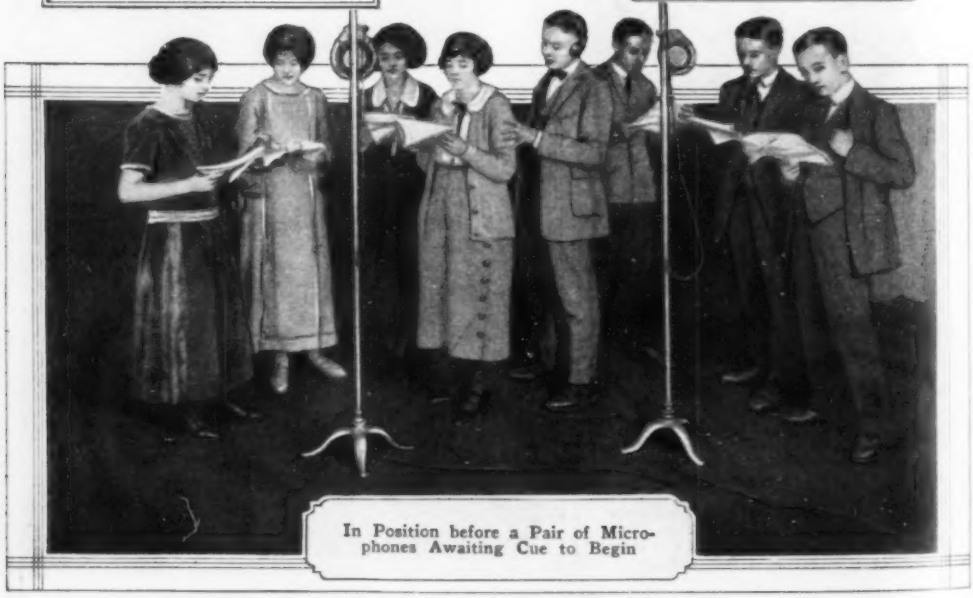
Above, Once a Chief Source of Large City's Entertainment, This Theater Long Since Passed into History; Left, Billboard Display of Character Rapidly Being Relegated to Smaller Communities by Movies and Radio

Radio Dramatists Reading the Lines of an Absorbing Scene into a Pair of Microphones Provided to Insure Perfect Transmission

Poster of a Play That Is Still in Demand by Theatergoers Whose Faithful Preference for the Old Standards Is Demonstrated by Box-Office Receipts; Insert, Well-Known Stage Star in Action before a Microphone

Unseen Struggle in the Broadcasting Room Which Helps the Actors in Reading Their Lines

Casting a Radio Play with Director and Actors Preparing for First Rehearsal of Story That May Thrill a Million Hearers; Left, Scene That Can Be Wirelessed with the Aid of Noises



In Position before a Pair of Microphones Awaiting Cue to Begin

During Tense Situation in Studio While Thrilling Words of Play Are Being Emphasized by Property Man, Whose Important Duty Is to Follow Action of Piece with Realistic Sounds; Below, How Amusement-Seeking Public Was Attracted to Wonders of Museum of Long Ago

closing the door so the sound will not only carry through the air that is full of market reports, static, bedtime stories, monologists, darky quartets, pianists, saxophonists, lecturers on how to make strawberry pie, speakers on Europe's problems, jazz bands, brass bands, orchestras, and not only carry through all that, but still sound like a door opening or closing when it is received.

At the WGY studio, Schenectady, N. Y., where eighty-five plays were reproduced and broadcast in eighteen months, that problem of the entrance and exit of a character was solved by building a special portable door and door frame. The door is constructed of thin oak and has a peculiar resonant quality which makes its opening and closing readily recognizable as a door by the sound. Likewise the lock has a highly gifted click, which transmits well through the ether.

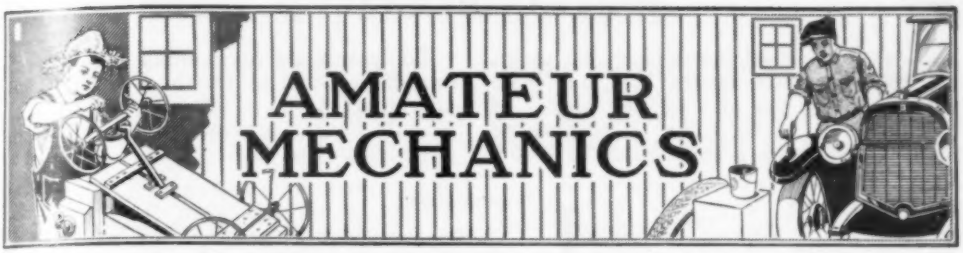
Next to the door, which heralds the arrival and departure of every character in an indoor set, the most overworked property device is the bell board. It consists of a convenient arrangement of five bells of different tones and a buzzer, with the necessary dry cells and buttons. There is a doorbell, telephone bell and an alarm gong which may be sounded for fire, ambulance or as a burglar alarm. A clock chime and a tap bell complete the group. But getting back to Pierre, in the drama "Pierre of the Plains." The shot rings out on the still night air and Pierre falls, feigning death among the leaves. A property revolver in the hands of the stage director fired the shot, and a pile of crumpled onion-skin paper on the floor provides the rustling leaves. Beside the paper is a big microphone which carries the sound across the continent.

At the approach of the villain, who believes he has killed the hero, Pierre grapples with him and they struggle among the rustling paper. Pierre is victor, of course, and the winner finally mounts his horse and rides away. A young woman perched on the grand piano, where she will be out of the way of the action on the floor, supplies the sound of horses' hoofs by clapping two sticks together.

A revolving-barrel thunder machine produces thunder just as on the stage. Tin pans, a wire carpet beater, dishes and other homely devices are used to simulate other sounds. Frequently considerable experimenting must be done to find a device that will sound right over the radio.

There is plenty of action in many of the plays, despite the fact that the characters are reading their parts from the script, which must appeal to the ear.

Simple Means Are Employed to Imitate the Various Natural Sounds Necessary in the Production of a Play for the Radio; the Kiss Produced for Broadcasting and as Seen on the Stage



The Mysterious Submarine

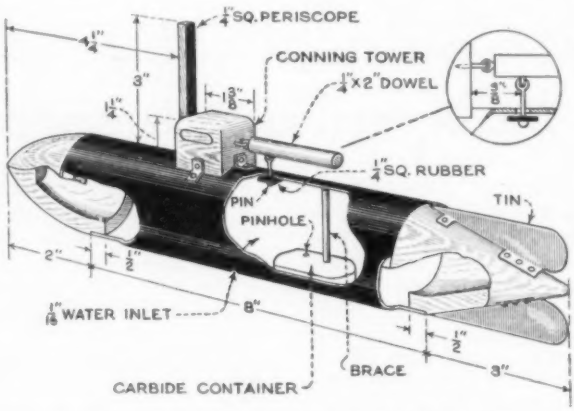
By F. D. BURKE

THE interesting little toy described in this article will, when placed in water, automatically dive and come to the surface again, repeating this performance, on an average, once a minute over a long period of time. It not only makes a very good toy for a boy but can be used also for advertising purposes. Placed in a glass tank and displayed in a show window, its actions will attract the attention and interest of passers-by, who will stop to wonder how it operates.

The hull consists of an 8-in. length of 20-gauge brass tubing, 2 in. in diameter. The ends of the tubes are fitted with two water-tight wooden plugs, so shaped as to give the hull the characteristic cigar shape. These plugs are made hollow, as shown. The operation of carving out the inside of the plugs, however, should not be completed until the hull has been tested for balance. When properly balanced, the hull should sink in a perfectly horizontal

Toy Submarines That Will Submerge and Rise to the Surface Automatically Can Easily Be Made by Any Boy. They Are Also Useful as Attractions for the Store Window

position. Attached to the plug that forms the stern are two vertical fins, cut from very light tin and attached by means of No. 20 nails, ½ in. long. The conning tower is cut from a solid block of wood. It is fastened to the hull by means of small brass angles, nailed to the conning tower and soldered to the hull. The periscope is a 3-in. length of ¼ - in. dowel stock, and attached to the tower by three No. 20 nails, ½ in. long. A 2-in. length of ¼-in. dowel is hinged to the after side of the conning tower by two wire staples. At the point indicated in the drawing a 1/16-in. hole is drilled in the tube of the hull. Through this hole projects a heavy brass pin, under the head of which is a ¼-in. square cut from a heavy rubber band. The other end of the pin is bent to form an eye, and is attached to the dowel by another small staple. The action of this part of the mechanism is as follows: When the submarine is submerged, the dowel acts as a float and pulls the rubber against the hole in the tube, closing it; when the submarine is on the surface the dowel acts as a weight and drops, thus opening the hole to the air. Another 1/16-in. hole is drilled in the bottom of the hull to allow water to flow in and out.



Construction of the Submarine, with Details of the Automatic Air Valve

To operate the toy, a small 1-oz. can of a flat shape, such as can be obtained from any drug store, is filled with carbide, a pinhole having previously been drilled or punched in the cover. The loaded can is placed in the hull in the position shown by removing one of the end plugs, and held stationary by wedging a length of match stick between the cover and the top of the hull. Upon placing the completed ship in the pond or tub, water will immediately start to flow into the hull through the bottom opening, and the submarine will slowly sink. When it is fully submerged the automatic air valve will close. The water will then slowly seep into the carbide container and form acetylene gas, which, in a short time, creates sufficient pressure to force the water out again through the opening in the bottom. As soon as the hull is sufficiently lightened it rises to the surface again. The air valve will then open, allowing the gas to escape, and the operation will be repeated until the carbide is exhausted.

After being thoroughly tested for balance and operation, the whole ship should be given several coats of paint, and, to increase its likeness to a "sub," portholes should be painted on the conning tower.

Glucose for Anti-Freezing Solution

In tests conducted to determine the efficiency of glucose as an anti-freeze agent, it was found that a solution of one part glucose and four parts water became slushy like wet snow at 20° F., stiff at 15° F., and hard at 10° F. A solution of one part of glucose and five parts of water gave practically the same results. It is evident that the rotary pump on any car can be seriously damaged by the use of such solutions if exposed to temperatures of 15 to 10° F. On the other hand, glucose was discovered to be a good substitute for glycerin in a glycerin-alcohol mixture. One part of glucose, one part of denatured alcohol and four parts of water, by volume, make a satisfactory anti-freezing solution. It does not begin to thicken until the temperature reaches 8° F., and becomes slushy first at zero temperature. —John C. Lee, Wellesley, Mass.

Removing Odors from Ice Box

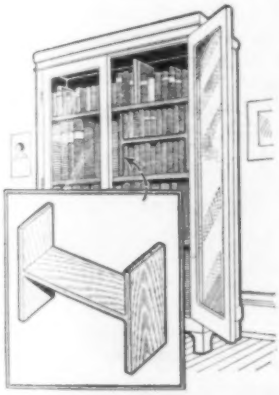
Odors in an ice box can be eliminated by placing a pan of coke in the bottom of the box. This will absorb all the gases and prevent the milk from tasting like onions or vegetables. In factories also, where bad odors are apt to spoil the men's lunches, a box can be constructed to hold them and a large pail of coke placed in it.

Linoleum Replaces Auto Carpet

Gravel, brought in on the feet, cuts and rapidly wears the floor carpet in an automobile. A piece of linoleum, preferably inlaid and plain brown or green in color, should be substituted for the carpet. It is carefully fitted and cemented to the floorboards with linoleum cement or white lead, and will wear as long as the car is used. Before laying the linoleum, all holes in the boards should be plugged up and irregularities planed off. The linoleum is finally waxed or a coat or two of varnish applied. This will prevent stains and oil spots from being absorbed. When a dressier appearance is desired, the carpet may be replaced in a few moments.

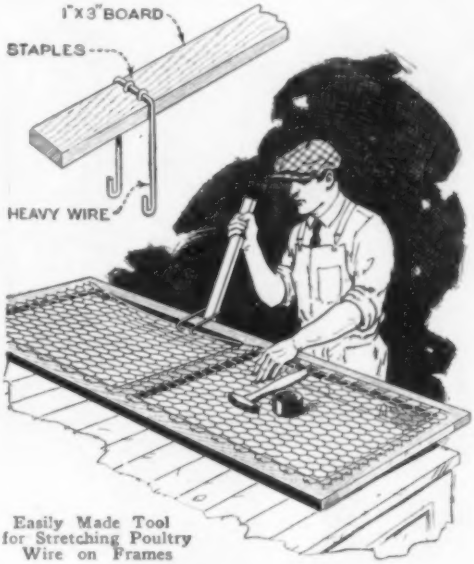
Extra Bookshelf Economizes Space

In nearly all bookcases some space is wasted when large volumes have to be accommodated. Two shelves usually have to be spaced widely apart to take the largest books. If there are not enough of these to fill the whole shelf, an extra shelf can be fitted as shown to take two or more rows of smaller books. As shown in the insert, this shelf consists of two vertical and one (or two) horizontal boards, its length being determined by the space left vacant. The horizontal board or boards are fastened to the uprights by wood screws passing through the latter. To give the whole a good finish the front of the extra shelf may be covered with veneer or varnished to match the case.—C. A. Oldroyd, Barrow-in-Furness, England.



Stretching Poultry Wire

Stretching poultry wire on frames is a difficult task if attempted with the fingers. The tool shown in the illustration, which can be made in a few moments, will save much time and work and prevent sore fingers. A 3-ft. length of 1 by 3-in. board, a piece of No. 9 iron wire and two small staples are the only materials required. Form a hook on each end of the wire and then bend the wire around the 3-in. side of the board, about 4 in. from the end,



Easily Made Tool for Stretching Poultry Wire on Frames

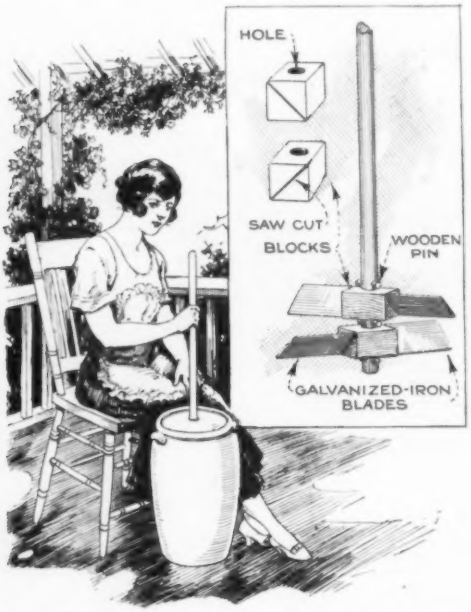
tacking it in place with the staples. After the wire is tacked to one side of the frame, the stretcher is used to pull it tight. This is done by catching the hooks in the selvage of the wire and, resting the short end of the board against the outside of the frame, pulling back on the long end.—G. H. Sulzer, Rose Tree Road, Pa.

Screw Caps for Tanks

Many of the tanks sold for carrying an extra gallon of gas or oil in the auto have openings that are too small for the filling nozzle at the service station. It is a simple matter, however, to fit a new cap that will answer the purpose. Get an ordinary grease cup, such as used on heavy machinery, measuring from 2 to 3 in. in diameter. Saw off the cup just at the bottom of the large cap threads, as shown in the illustration, and discard the lower portion. Cut a hole in the tank and insert the threaded cup, allowing a thread or two to extend inside. Solder carefully all around the edge of the cup, drill a small air hole in the cap, and the job is finished.—N. T. Peterson, Corvallis, Oreg.

Effective Churn Plunger

The work of churning is hastened considerably by using a plunger with two



Churn Plunger with Two Revolving Blades Lightens Task of Butter Making

blades that revolve in opposite directions. The plunger is a wooden rod with three holes drilled through it in the lower part for wooden pins. Two square blocks, drilled to fit on the plunger rod and just wide enough to fit loosely between the pins, are attached as shown. Slots are sawed diagonally in these blocks to receive the blades, which are cut from heavy galvanized iron. The plunger is worked up and down in the usual way.—E. K. Wehry, Cedar Rapids, Iowa.

Testing Brassware

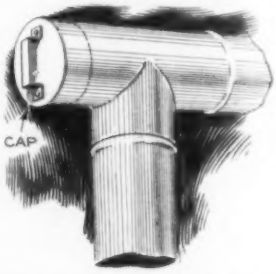
Many articles of household brassware on the market, such as candlesticks, crumb scrapers, vases, etc., are not solid brass but merely a base of sheet steel covered with a layer of brass plating or a thin sheath of spun brass. By using a small magnet as shown in the photo, the shopper can detect the steel under the brass.—C. E. Weibezahl, Syracuse, N. Y.

Simple Trick Saves Alarm Clock

Many perfectly good alarm clocks are thrown away every year because the oil with which they are lubricated collects a quantity of dust. The dust particles, although small, are sufficient to gum the mechanism, and, as a thorough cleaning often costs more than the clock is worth, it is discarded. The following kink will save the clock, however. Place it face down on a hot stove and allow it to lie in this position for several minutes. Remove it with a cloth, to avoid burning the fingers, and a few vigorous shakes will usually suffice to start the mechanism. The cure is due to the fact that the thorough heating has thinned the oil, and caused it to flow from the bearings, carrying the dust with it.

Clean-Out Tee for Furnace Smoke Pipe

In furnace smoke pipes arranged at a slight angle or in a horizontal position, a deposit of ashes, soot and other dirt always accumulates, and the heavier portions fall to the bottom, obstructing the pipe and retarding the escape of the smoke and gas. In horizontal pipes the fine ashes stirred up when cleaning out the furnace sometimes are permitted to become heavy enough to cause the pipe to break, and when the furnace is not in use, they absorb moisture to such an extent that the pipe will rust through quickly. To clean out such pipes, it is usually necessary to dismantle them, which means a great deal of work and the risk of damaging the pipe. By the arrangement shown in the drawing, however, the work will be made easy. Instead of using an elbow, a tee that has a cap made to fit the open end is substituted, and the ashes become accessible by removing the cap.



Using Plywood

Plywood consists of a series of thin layers of wood, glued together with the grain of the layers running at right angles to each other, making a strong panel which will not split or break. If the layers are

glued together properly with a waterproof glue there is little danger of having the layers separated due to the action of moisture. Basswood is generally used where strength and light weight are required. Yellow pine and fir panels, as well as oak, have a bold and beautifully figured grain and are commonly used for door and window tops.

One advantage in using plywood is that unusually large surfaces are obtainable in a single piece. For example, a 3 by 6-ft. piece of plywood can readily be obtained, whereas it would be rather difficult to obtain a single, solid board of such dimensions. Also, such a big board would easily warp, but this is not the case with plywood. A disadvantage in using plywood, however, is that the edges must be concealed. This is done by mitering the edges or using molding.

In order to cut plywood smoothly a fine-toothed saw, such as a hacksaw, should be used; a coarse saw will cause raggedness on the bottom ply, as its grain is generally at right angles to that of the top layer.

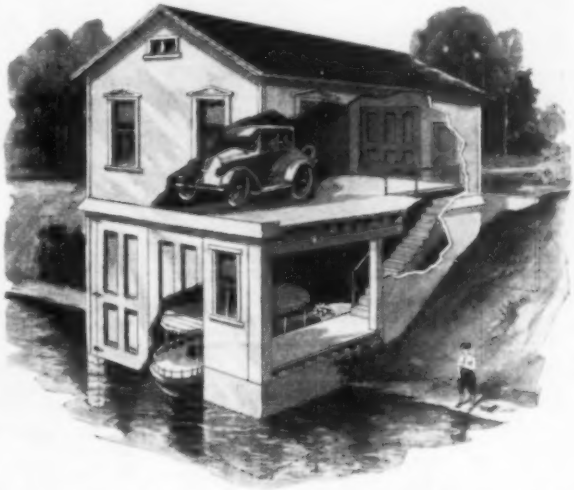
Bicycle Trailer for Carrying Children

Children are often given a ride on the handlebars of a bicycle but this is not very comfortable for the rider nor easy for the driver. For this reason a Winthrop, Mass., man made the bicycle trailer shown in the photo. It consists of a wooden frame built upon the axle of a discarded baby cab. Seats for two children are provided, and a wooden tongue extends from the frame. This is high enough to be brought over the rear fender of the bicycle and attached to the seat post.

Copyright, Keystone View Co.
Simple Bicycle Trailer That Is Safe and Comfortable

Combined Garage and Boathouse

Instead of building a separate garage and boathouse one architect constructed

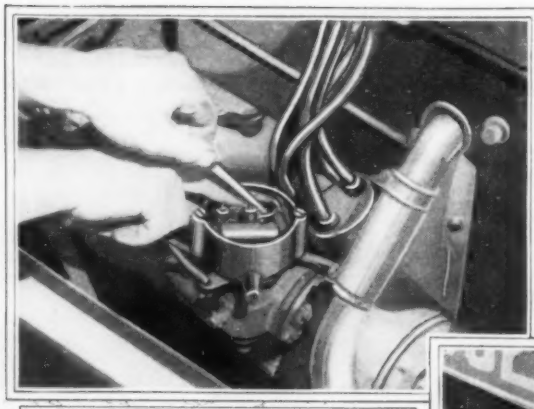


Combination of Garage and Boathouse Proves Economical and Convenient

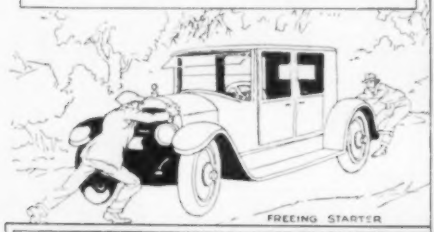
the combined shelter shown in the photo. The structure was practically a two-story affair, the lower part serving as a boathouse and the upper part as a garage. Stairs are built inside, as shown. Besides its economy and convenience, an advantage of this arrangement is that it serves as a common storehouse of fuel and supplies for both engines.—Wm. B. Thompson, Pittsfield, Mass.

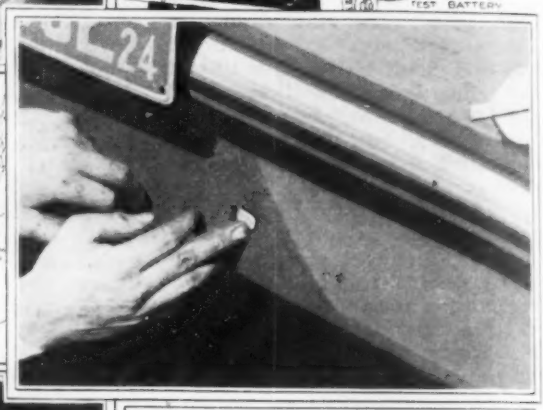
Removing Scratches from Auto

The finish of the auto body is often marred accidentally by screwdrivers, wrenches and other tools, and when the finish is good, the scratches stand out like the proverbial sore thumb. A simple method of removing such a scratch, or rather of hiding it so that it cannot be noticed, is to apply several light coats of shellac over it, keeping the shellac as thin as possible and applying it over just enough surface to cover the scratch completely. When the last coat has dried thoroughly, the surface is rubbed with crocus powder and olive oil on a cloth, to remove the ridges around the scratch. Crocus cloth can also be used for this purpose, taking care to use plenty of olive oil on it. When the surface has been rubbed until no trace remains of the ridges, a coat of good body polish should be applied.

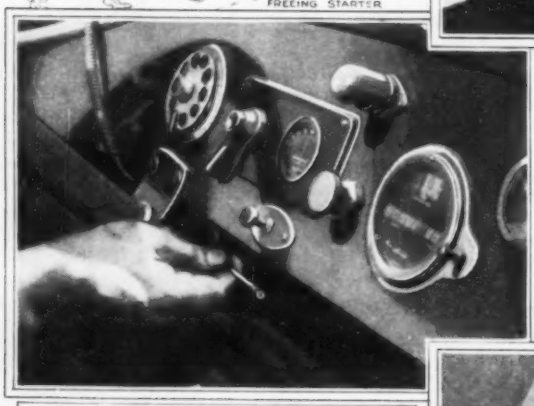


A Platinum-Point or Nail File Cures Fouled Distributor Points

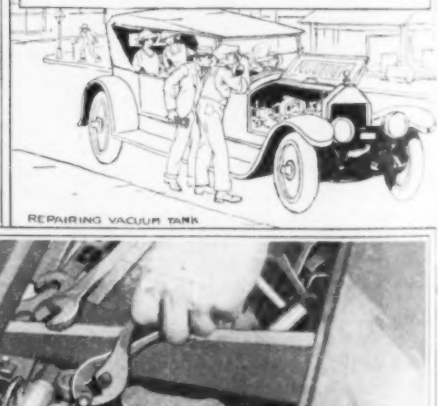




A Piece of Chewing Gum Stops a Hole in the Gasoline Tank



Loose Ammeter Connections Spell Trouble Often Hard to Locate Quickly



It Is a Simple Job to Tighten the Battery Terminals, If Loose

ADVENTURES OF AN AUTO TROUBLE SHOOTER

How to Prevent Breakdowns on the Road

LOOK at the gas, water and oil and give the tires a kick to see if they have enough air, when you get the old bus ready for touring. Under the seat, or in the box, is the tool kit provided by the manufacturer. If you are wise, there's a set of chains and a steel towrope, too. And if you are not only wise, but brilliant, you'll add a few extras in the side pocket. Borrow mother's manicure file and put it there, in a handy place. Beg a few sticks of chewing gum from sister, and finally get a handful of those wide rubber bands out of the desk tray. Bring along a nail, too, for it may come in handy. With those few essentials you will be ready to cope with many of the troubles that arise in a modern motor car. A nail file, a wad of chewing gum and a rubber band are not luxuries for the car owner. Take the work of Porter Russell, head of the service department of the Chicago Motor Club, a garage chief whose emergency repair squads had 22,471 calls from stranded motorists last year. Ignition trouble alone accounted for 10,173 of those calls, and every man on the emergency squads carried a nail file to correct the commonest of all ignition troubles—fouled points. Take off the distributor head when the ignition goes wrong and then step on the starter. If the ignition points don't spark, spread them a bit, slip the file between them, press them tightly together, and withdraw the file, repeating the operation until the points are true. A five-cent file in the car pocket may save an expensive garage call. A regular distributor - point file is much better, of course, but more expensive and easier to break. And as for chewing gum, its uses are legion. It will stop a leak in the gas tank, or plug a hole in the pressure-feed system. And the chewing gum or the rubber band can be used to make an emergency repair on a leaky vacuum-tank float.

The electrical system is the weakest

Popular Mechanics asked the head of the service department of the Chicago Motor Club to tell the most frequent causes of trouble to motorists on the road, and describe how the car owner could make his own simple emergency repairs.

The service department of this auto club handled 22,471 calls for help last year. Of this number, 15,548 were taken care of by repair men mounted on motorcycles with sidecar tool kits; 4,865 required service cars; 966 were answered by both motorcycle and service car; and 1,092 were canceled because the driver found the trouble. The repair crews traveled 62,616 miles and their repair jobs included:

Battery	2,903	Lock	1
Brakes locked	109	Mud	250
Carburetor	1,222	Oil pump	21
Cold motor	24	Out of gas	518
Frozen	365	Out of water	5
Horn	9	Starter	1,553
Ignition	10,173	Tires changed	631
Wrecks	4,125		

point in a motor car. It can go wrong in more different ways than all the other parts of the machine combined, but with a bit of knowledge and a few simple materials probably half the troubles that bring cars to a stop could be repaired by the driver, without recourse to the garage. Out of those 22,471 calls answered last year there were not only 10,173 classified as ignition troubles, but 2,903 due to the battery, 1,553 to the electrical starter and even nine cases of horns that declined to blow—all faults in the electrical system. Thirty per cent of the ignition complaints were caused by fouled points, and were corrected by the repair man with a few strokes of the handy file. Sixty per cent were the result of loose wires or battery terminals, and the other 10 per cent came from worn-out switch tumblers, burned-out coils, shorts in the wiring system or broken wires.

Of the 60 per cent due to loose wires, the majority were the result of one of three things, all of which could easily have been corrected by the driver. Loose ammeter connections came first. A single wire leads to the recording ammeter on the instrument board, and is fastened with a screw terminal. Frequently it works loose. If it comes off entirely, there is a break in the electrical system. In that case the car not only will not start, but the horn will not blow nor the lights work. If horn and lights do work, the trouble cannot be a broken circuit there, and can be traced to distributor or coil, or, possibly, corroded battery terminals. They may be corroded so badly that sufficient current will not pass to operate the engine or starter, and yet allow enough for horns or lights. The file will clean off corrosion, however, and enable a good connection to be made.

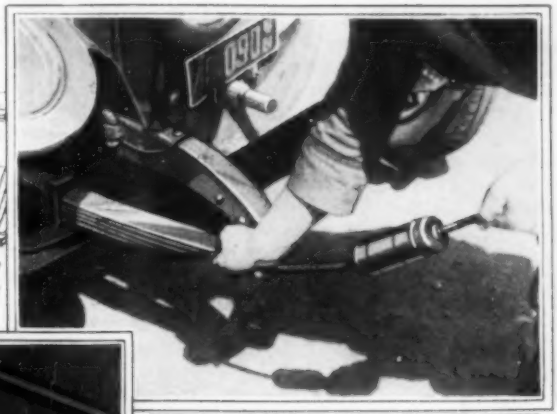
There is more trouble with an ammeter wire getting loose without coming off than there is if it becomes entirely detached. Then it may remain in contact for some distance, and suddenly jolt free. The driver experiments with the car for a bit, when perhaps the wire will establish contact again, only to break it later, and keep on repeating until the nut of the terminal is tightened.

Next to loose ammeter wires come loose battery terminals. Again the horn or light test will show whether there is a complete break in the circuit, or, like the ammeter wire, they may be only loose, so as to make and break the connection; or, again, they may be filmed over with the bluish foam of corrosion. Battery trouble, which included 2,903 of this one club's repair calls, is usually the result of neglect, allowing the battery to run down. A stop at the garage or battery-service station every two weeks for testing and filling with distilled water would prevent most of the trouble here. To determine if the coil is burned out, it is only necessary to remove the connection leading from the center of the distributor to the coil and to hold it about ¼ in. away from its terminal. If, when the engine is cranked, a spark jumps from terminal to wire, the coil is working properly and the trouble lies elsewhere. This test should be used with intelligence, however, and only after making sure that the wires leading from battery to coil are in good shape and have good connections.

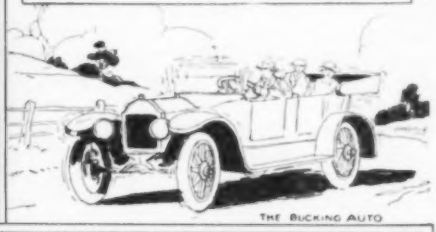
Starter trouble in 90 per cent of the 1,553 cases was confined to a stuck starter drive, while the other 10 per cent included worn-out brushes or damaged commutators. The cure for the stuck drive is simple. Put the gear in high, making sure that the ignition key is turned off, and then push the car backward and forward with a quick, rocking motion, and the drive will be loosened. The backward motion is the one that frees the drive. Never tow a car forward with the starter stuck, as the forward movement only jams it tighter. Worn-out brushes may cause considerable damage to the starter. If too low, they will cause an electric arc which will burn and pit the commutator and, in some cases, even melt the solder in the armature connections. The only preventive here is an occasional inspection by the garage man. The starter is a little too complicated, and too unhandily located for the average driver to tackle.

Carburetor troubles accounted for 1,222 calls for service. The expert's best advice is, "never fool with the carburetor of your car." No matter what may be the trouble with a car, a lot of people immediately start picking on the mixing arrangement. "A carburetor, if once adjusted right, seldom gets out of adjustment," says Mr. Russell, "but a lot of drivers let every Tom, Dick and Harry who comes along the road and offers his assistance, start fooling with the carburetor. Then when they give up the job and our repair crew is called, we not only have to find the original trouble and fix that, but readjust the carburetor as well." His advice is to confine your carburetor investigations to clean the filter screen of dirt and water.

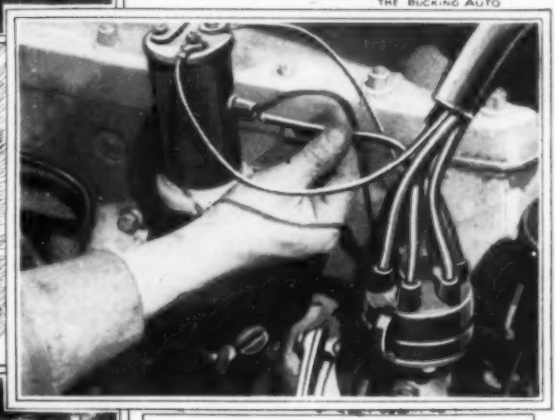
Gas-line and vacuum-tank troubles likewise are usually the result of dirt or water, and the screen in the vacuum tank and the drainage sump in the bottom of the gas tank should be cleaned at intervals.



An Occasional Shot of Oil on the Springs Saves Leaves

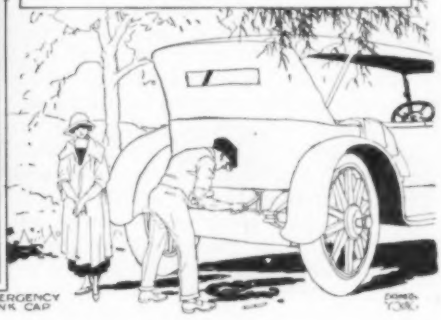


A Length of Inner Tube Protects the Distributor from Rain



Testing the Ignition Coil to See If It Is Burned Out

Adjusting the Horn Is an Easy Matter for Any Owner



Clogged gas lines accounted for 554 trouble calls last year. One device on the market now makes cleaning simple, reminds the motorist to do it, and likewise keeps dirt away from the vacuum tank. It is a filter with a glass bowl, so that the driver can see the gasoline passing through on its way to the vacuum tank, and can see the dirt collecting in the filter screen, where it can easily be removed.

Getting back to the chewing gum and the rubber bands, how many motorists know what to do when the solder on the vacuum-tank float works loose and opens a minute hole through which gasoline seeps into the float ball? The hole is usually so small that the gas may take days in filling the ball, but once its buoyancy is gone, trouble follows. The symptoms are flooding of the vacuum tank, the carburetor, and even leakage of gasoline from the exhaust, for the suction of the intake manifold draws raw gasoline into the cylinders in a steady stream. The motor-club repair men make an emergency repair by punching two small holes with a nail on opposite sides of the float, then blowing in one to drive the gasoline out of the other. When the ball is empty, they snap a wide rubber band around it, covering both holes, restore the float, and the car is ready to go on to the next service station to have a new float installed. In the absence of a rubber band, the two holes can be stopped up with bits of chewing gum.

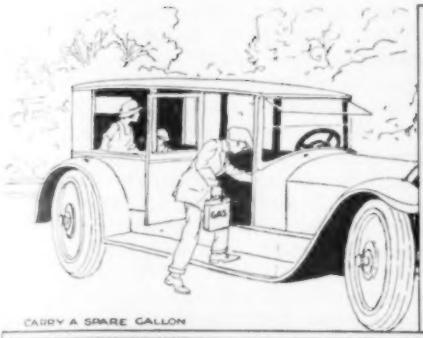
The motorist who runs out of gas we have with us always, and, strange to relate, his numbers remain constant. This club carried gas to 518 drivers who were stranded far from filling stations last year. As stated, the number of careless ones is practically the same month after month and year after year. As fast as one is cured by experience, it seems another takes his place. Devices are made to warn the driver when his tank is nearly empty. One, working on a different principle, holds back a gallon of fuel, and when the last dying gasp indicates an empty tank, the driver need only pull a rod and release the reserve supply. The old reliable remedy against being caught without gasoline, however, remains a spare can under the seat. An old gallon oil tin, fitted with a cork, will do. If the driver is more particular, he can get a set of three neatly painted red, white and blue cans for spare supplies of water, oil and gas, fitted with clamps to attach to the running board, or to go under the seat or in the back of the two-passenger car.

Only five out of 22,471 motorists who called for help last year needed water, the small number probably being due to the fact that water usually may be obtained from the nearest home.

The winter season brought 365 unlucky car owners who let their engines freeze solid, so solid that they had to be towed in for repairs to cracked cylinder jackets, or other troubles. Yet every service station sells alcohol and is equipped with a chart showing the proper amount to use to guard against freezing at any given temperature. Alcohol, unfortunately, vaporizes much more quickly than water and needs frequent replacing to keep the mixture up to standard. Failure to observe that fact accounts for most of the cases of freezing. Inability to start because of cold motors brought twenty-four appeals for help. A cold motor, a run-down battery, and add to that the wrong grade of oil—one too heavy for winter weather—and a call for the trouble man is the result.

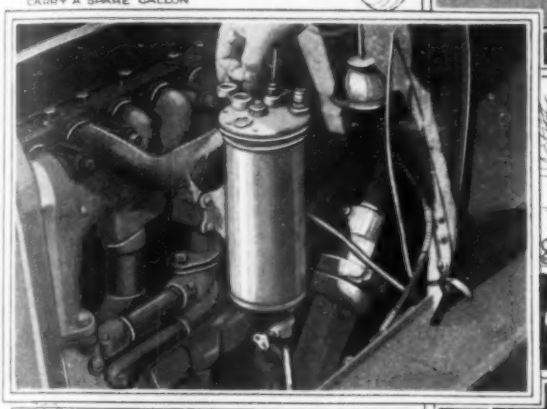
Two hundred and fifty motorists got stuck in the mud in one year among this club's membership. The automobile clubs will rescue the member who gets stranded in the mud on a public road, but don't drive off the road into a field if you expect your club to come to the rescue. They won't do it. The service manager's advice is: Don't try bad roads. "Everybody thinks his old can has about seventeen more horsepower than anybody else's bus of the same make, and can get through where the other fellow's car can't," the service head explains. "Result, we get the calls for help. If you do get stuck, don't try to put on speed to get out, for you'll only spin the wheels and sink deeper. Put the engine in low, go slow, and don't try to turn from side to side. Keep straight ahead. If your front wheels are turned, the engine must push the car against the weight of the mud ahead. If the wheels start spinning, put on the emergency brake just enough to stop the spin. That will frequently enable them to take hold. If you can get any old rope, board, bushes, sacks, or even a quantity of paper, put it under the wheels to help give traction."

Also, he advises, if you have chains, put them on before tackling wet or muddy roads. A big cab company, operating 2,750 taxicabs of its own, and manufacturing standard cabs for similar companies all over the world, has an ironclad rule that at the first sign of rain every driver must stop and put on his chains. Experience, and not a desire to help the chain manufacturer boost his sales, is behind that order.

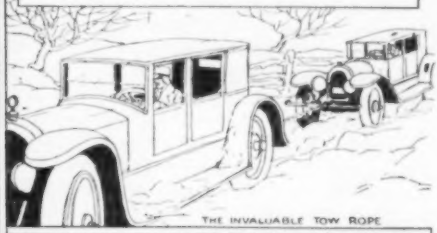


CARRY A SPARE GALLON

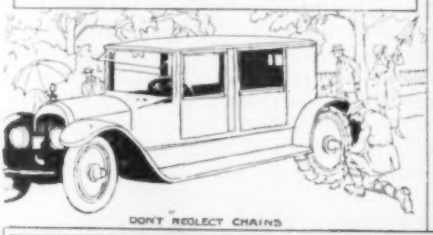
A Nail Driven between Connector and Post Tightens Battery Connection



Cleaning the Vacuum-Tank Strainer Prevents So-Called Carburetor Trouble

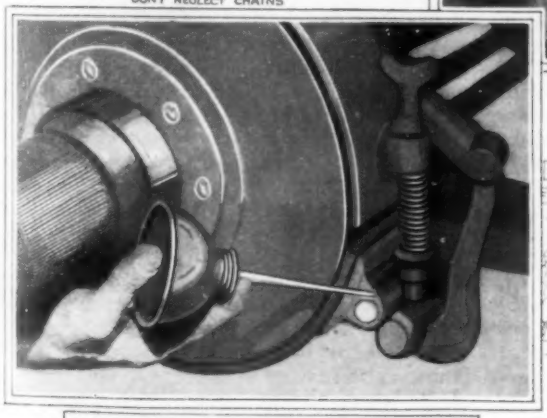


THE INVALUABLE TOW ROPE

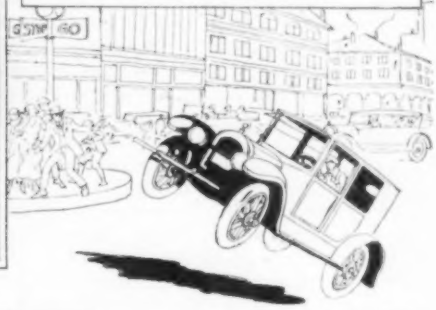


DON'T NEGLECT CHAINS

If the Hole in the Gasoline Tank Is Plugged the System Balks



Locked Brakes Can Be Prevented by a Dose of Penetrating Oil Now and Then



LOCKED BRAKES

The service manager also advises every driver to always carry a towrope coiled under the seat, where it won't take up much room. With it you can stop and help the other fellow out, but, more important still, the other fellow, who perhaps hasn't a towrope, will stop and help you out if you have it.

Locked brakes accounted for 109 of the club's calls for help. Every now and then locked brakes cause a bad, and sometimes fatal, accident. In a spectacular accident in a middle-western city not long ago, the brakes on a four-wheel brake car became locked on a smooth boulevard. The sedan struck a safety isle, did a neat carom, turned a somersault, and landed upside down, showering the driver with broken glass. Fortunately the sturdy top construction held up, and the owner crawled out, badly cut and bruised but alive. The damage included a broken front wheel, all windows smashed, and top and sides badly dented, while the paint job was nearly a total loss. A can of good penetrating oil and an occasional inspection of the brake rods and clevises will prevent locking of the brakes, which is usually due to rust in the joints.

Rust causes all kinds of accidents, including broken springs. The spring leaves will not slide smoothly over each other as they bend if they are badly rusted. The result is a hard-riding car, and eventually a broken leaf or two. If you change your crankcase oil at home, the service manager recommends taking the old oil, loading up the grease gun, and squirting it over the springs. To return to the car's electrical system, a hard thunderstorm will flood the service station with frantic appeals for help, when all that is the matter is a wet coil, distributor or spark plugs. An average rainstorm will bring in 600 calls in a single day—ten times the usual number. The cure is simple—an old oilcan filled with kerosene. Whenever a rain comes up, the motorcycle emergency crews get out their cans and a half gallon of kerosene, to do a job the owner could do if he knew how. Kerosene squirted over the distributor, coils and spark plugs will carry the water away, and a few swipes with a dry cloth will finish the job. Never lift the motor hood during a rain, however, unless you have an umbrella or other covering ready to hold over the engine. Likewise, if you wash your car at home, it is always wise to place a waterproof covering over the motor.

Water trouble around the distributor head can be avoided by cutting off a section of an old inner tube, 8 or 10 in. long, and placing it over the wires, tying it at the top. The little funnel-shaped cup made by the puckered rubber above the tie can be filled with melted paraffin or wax to make a water-tight joint.

An occasional source of trouble is a plugged gas-tank cap. The vacuum-feed system will not work unless the small hole in the cap is kept open, to let air in to replace the gasoline drawn out. Occasional attention with a pin will keep it free from dirt.

Every make of car has its own quirks. When a Ford, for example, starts to bucking it may be traced to a broken timer spring. An emergency repair can be made by drawing out one coil of the spring and bending a new hook. Another frequent cause of bucking at low speed is a dirty spark plug. One popular medium-priced car has been causing considerable trouble because of broken insulation on the high-tension wires in the late models. On the car in question the trouble comes from an arrangement whereby two high-tension wires are clamped between two metal plates. The wires fit into grooves and are held in place by tightening two thumbscrews in the plates. A motorist having occasion to remove the outer plate, is apt to let the wires slip out of their grooves and then the thumbnuts will tighten against them, crushing the rubber insulation. Another, and much higher-priced car, has high-tension trouble in a different place. The wire leading from the center of the distributor to the coil passes up beneath the instrument board in front of the passenger's feet, and occasionally he will kick it off in shifting his feet.

Nine motorists who appealed to the club for help last year because their horns would not work, and who didn't dare drive through city traffic without a signal device, could have saved time by knowing a bit about electrical horns. A loose connection, lack of a drop of oil to keep the armature turning freely, or need of a few turns on the adjusting screw caused the trouble. All three can be corrected from the outside, without taking down the horn. Most signal devices for automobiles are equipped with adjusting screws to regulate their tone. Occasionally the jar will cause the screw to work loose, until finally the revolving armature does not come in contact with the diaphragm.

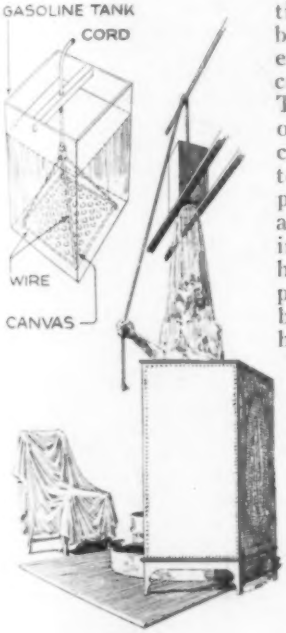
Lost keys occasionally bring calls for help. The service manager advises having three keys, one at home, one on the key ring for the car, and the third on the regular key ring in your pocket. The key at home is insurance against losing both

the others, and, if you have a closed car, the one in your pocket guards against shutting yourself out of your own car by leaving the other in the ignition lock. One motorist, for example, had to hunt through the dark on a lonely country road for a rock to break a $12.50 plate-glass window of his car because he carried both keys on one ring, and left the bunch in the lock.

The list of emergency repairs that can be made on the road is legion. One driver, for example, lost the cap from the gas tank which operated on the pressure-feed system. An emergency cap was made from a section of an old inner tube, but, lacking wire to fasten it in place, he formed an air-tight seal by placing the jack on the rubber cap, and then screwing it up against the body of the car.

An Improvised Shower Bath

We have found the improvised shower bath shown in the drawing very successful in the Philippines where we had no water connections, and it will be found equally effective on a camping trip. Take a 5-gal. oil or gasoline can, cut off the top, and nail a piece of stick across the opening to serve as a handle; then puncture a number of small holes in the bottom. Cut a square of heavy canvas to cover the bottom of the can, and tie a cord from each corner of the canvas to another one running over a beam or anything else convenient in the house or tent. Support the can overhead in any suitable manner. Fill the can (the canvas will hold the water for some time), step under it, and pull the string. This lifts the canvas, and the water pours out of the holes in the bottom. An ordinary shower head may be soldered into the bottom of the can if desired.—Mrs. L. G. Smith, Iloilo, P. I.

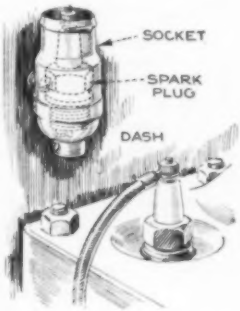


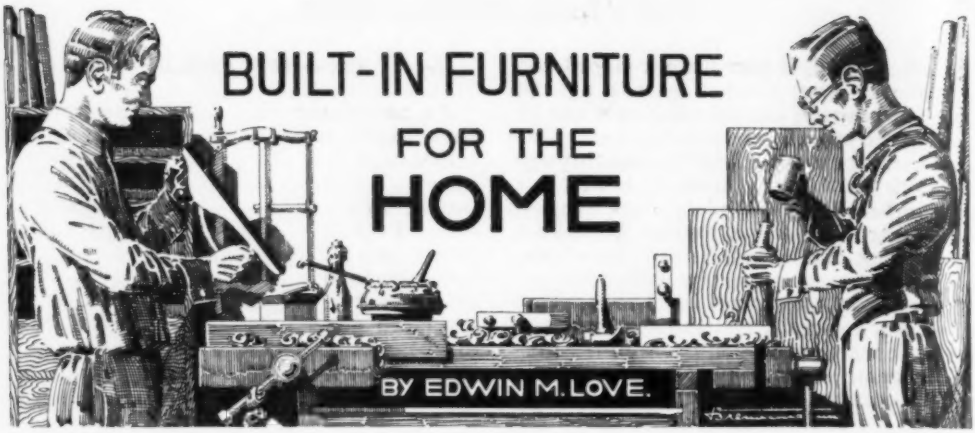
An Arrow Parachute

An arrow parachute gives the youngsters much delight. It consists of an ordinary arrow and a square piece of cloth, heavy cord being tied to the corners of the cloth and to the arrow, just below the head, as shown in the drawing. The arrow is handled in the usual way with the cloth folded over the head. While it is traveling upward, the cloth stays tightly around the stick, but as soon as the arrow starts downward the cloth opens and fills up with air, causing the arrow to come down slowly. Of course, the head must not be too heavy or it will come down first and then the cloth will not open. The arrow must be shot upward vertically.–R. A. Johnson, Portland, Oreg.

Neat Spark-Plug Holder

The shell of an old lamp socket makes a good holder for carrying a spare spark plug. The shell may be attached to the inside of the dash by means of a screw or bolt, as shown in the illustration. A hole for the screw is punched or drilled through the shell opposite the slit used for the key or pull chain, and the screwdriver is inserted through this slit to drive the screw home. A spare plug carried in this holder will not be damaged, as the shell is lined with heavy insulating paper, and by wrapping the plug in a rag, it can be stuffed in tightly.





Part I—Routine Construction Details

THE modern home owes much of its charm to built-in furniture. This is natural, as such furniture is designed for a certain place and use in the house, harmonizing architecturally with the building and sharing the color scheme. Being readily shaped to fill nooks and corners that otherwise might be useless, built-in features are economical of space, and often serve to hide unsightly recesses in walls.

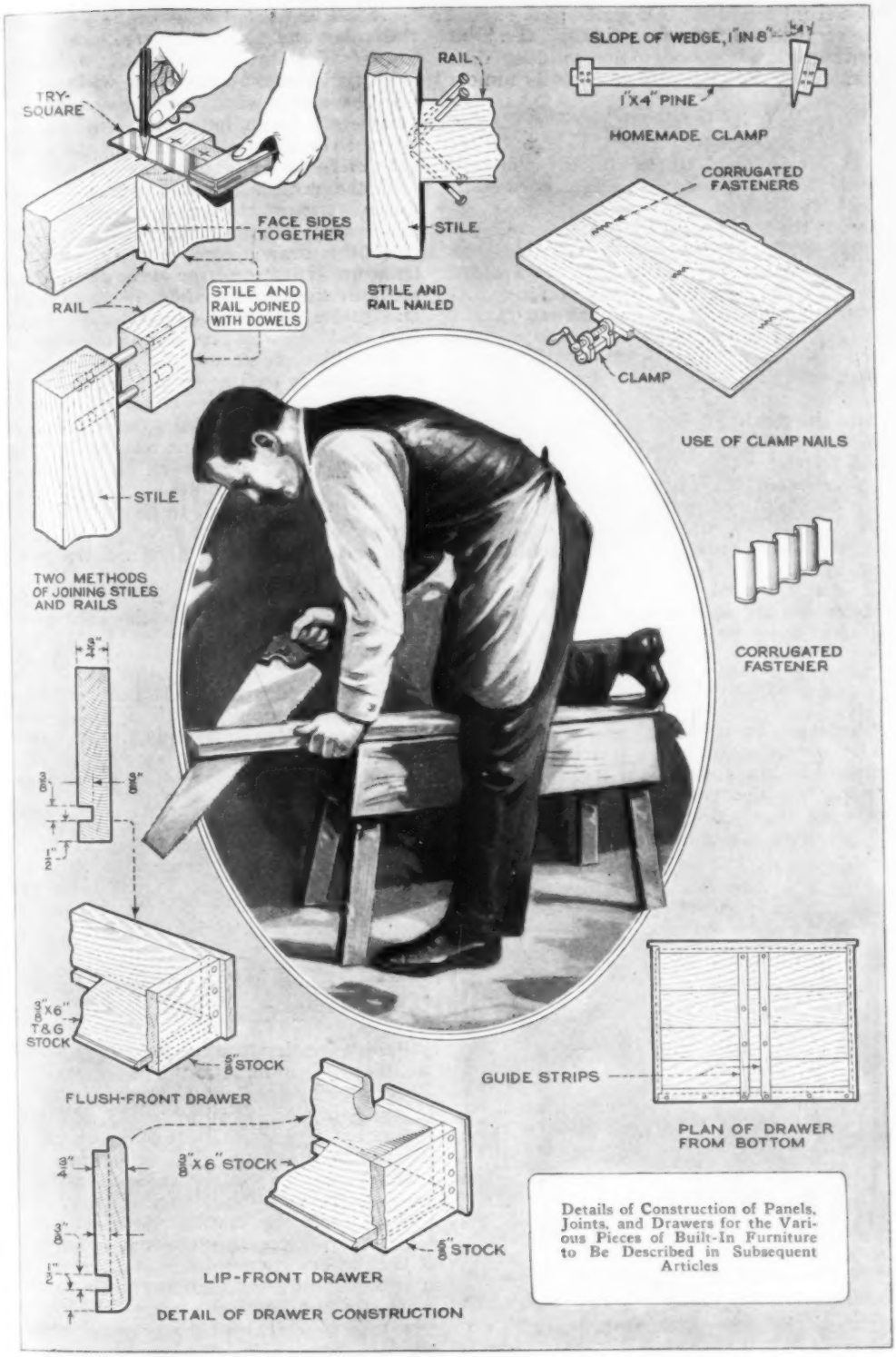
Happily, it is adaptable to most houses, whether new or old. The cost of installation, moreover, need not be prohibitive if the owner has had experience with carpenters' tools, for the building of such furniture is quite within the powers of the man who is capable of making neat joints in wood. Certainly any time so spent will yield a rich return in comfort and beauty in the house, while adding materially to the value of the property.

Since nearly all built-in furniture depends for much of its support and bracing on walls that serve either as a backing or a housing for the cabinet, there are certain routine processes common to all, which, once known, take much of the difficulty out of the construction.

The drawing illustrates two methods of joining stiles and rails. The stock used is commonly listed as 1⅛ by 3 in., but actually it is more often 1 1/16 by 2⅝ in., due to material lost in surfacing at the mill. Hence if the builder desires material exactly 2 in. wide he must mark it "net"; but, if it comes crooked, subsequent planing to straightness will make it rather undersize. For inexpensive work the nailed joint is very common; and under certain circumstances, especially if reinforced by blocks glued and nailed behind, may be quite substantial. To nail a rail to a stile in this manner, clamp it into place and drive a six-penny finish nail into each edge, being careful to keep the face sides flush and the edges in position. Then drive another nail in each edge and set them all up. With doors and drawers in position in the completed cabinet, the nails are concealed. If the stiles are in such a position that no clamp can be used, block the lower edge of the rail while nailing, and careful work will bring a tight joint.

The doweled joint is preferable to the nailed, and should be used in home work of this kind. To lay out for the dowel holes, mark a line with the gauge on the end of the rail from the face side and on the edge of the stile, and, placing the two face to face as shown in the drawing, square across both pieces. The intersecting lines are then pricked with a nail or awl for easy centering of the bit in boring. For 1⅛-in. stock ⅜-in. hardwood dowels entering 1½ in. into each piece are sufficient. Bore the holes ¼ in. deeper—1¾ in. to the bottom—to allow for air and glue imprisoned below the end of the dowel. Take care that the holes enter squarely, especially in the making of panel doors, for if they are out of true the frames will twist, even though care is taken to dry them flat. It can be taken for granted in door making that if the door does not lie flat of its own accord when first assembled, it will not long remain flat when subjected to the strains of shrinking and swelling.

Narrow boards are doweled together to make wide ones, or are glued and reinforced with corrugated fasteners. These fasteners, or clamp nails, are driven into the backs of the boards across the joint while the pieces are still in the clamps. For good results the work should not be removed from the clamp until dry, as the tendency of these fasteners is to draw the back of the joint together and to open up



Details of Construction of Panels, Joints, and Drawers for the Various Pieces of Built-In Furniture to Be Described in Subsequent Articles

the front slightly. All waste glue should be scraped from the face side and the joint surfaced and sanded; the sanding dust caught in the glue makes the joint almost invisible.

For built-in furniture, drawer making is comparatively simple. The fronts are usually of ¾-in. stock, and the sides, of ⅝-in. material, are rabbeted into the ends, with the back in turn set in rabbets between the sides, six-penny finish nails being used to hold the joints. The sides and front are grooved to receive the bottom which is built up of ⅜ by 6-in. tongue-and-grooved pine or fir. The back is equal in height to the distance from the top of the drawer side to the groove, and is assembled with sides and front, the bottom being slid into the groove afterward, and held in position by brads. If a really high-grade bottom is desired, use three-ply panel veneer.

The front may be of the lip type, in which the top edge is rabbeted and a corresponding lip is left on both ends, the edges being rounded or chamfered for neatness. This front hides the fit of the drawer, and thus allows of some inaccuracies in size. If the front lacks a lip, the drawer must be made to fit very closely, so that when the front slides in flush with the stiles and rails but very small clearances will show. The front is ordinarily slightly wider than the sides, with the top edge beveled inward, and the ends project sufficiently to strike against stops nailed against the stiles, thus insuring the closed drawer front being flush with the frame.

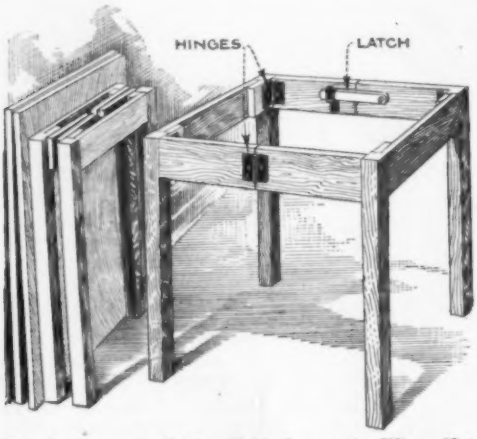
If the drawer has a center slide, thin guide strips must be put on the bottom, as shown in the drawing. To locate them, close the drawer, and, reaching upward from underneath, scribe along the bottom on both sides of the slide. Rub the runs and guides with soap or paraffin to reduce friction. A well-fitted drawer, even if wide, will close readily by pressure from either end as well as from the center.

Clamps are expensive to buy, but substitutes are easily made. On a suitable length of 1 by 4-in. pine nail solidly two crosspieces, one near each end, allowing 1 in. more of space between them than the width of the frame to be clamped, and putting one piece on at an angle of 1 in. in 8 in. Against this is driven a wedge of corresponding pitch.

Subsequent articles will describe the construction of many articles of built-in furniture in detail.

Substantial Folding Tables

Caterers, hotel keepers and others using a large number of tables, which have to be carried from place to place frequently, will appreciate the compactness and sturdiness of the folding table shown in the illustration. It is made in two parts, the top and the supporting framework. Two opposite side braces are stationary while the other two are cut in the center as shown and provided with a hinge over this cut on the outside, and a hinge in each corner on the inside. A latch is arranged on the inside of the sidepieces to hold them rigid while in use. The method of folding the table is indicated at the left. The top has cleats on its underside to butt snugly against the inner edges of the sides so that, when it is put on, the table will stand squarely without any wiggling at the hinges.—A. C. Cole, Chicago, Ill.



Sturdy Caterer's Tables Fold Compactly When Not in Use

Starting a Balky Ford in Cold Weather

Faulty ignition, a weak battery and cold weather in combination usually make a Ford engine very hard to start; if the vibrator points are worn or poorly adjusted, the motor may prove quite balky on either battery or magneto. In such a case the quickest way to get the engine started is to coax the coil points to vibrate by rapidly tapping the vibrator arm with the fingers, while pressing the starter button. If the battery is completely run down, the ignition should be switched over to the magneto, and another person should spin the engine while the driver manipulates the vibrators as described.

Preserving Leaves in Specimen Book

The common method of preserving leaves by pressing them with a flatiron rubbed on beeswax may be improved in the following way: Paint the underside of each leaf with linseed oil and iron it immediately; then paint and iron the upper side in the same way. This treatment gives the leaves sufficient gloss and keeps them pliable. It is not necessary to press and dry the leaves beforehand, although this may be done if desired. The tints of the leaves can even be preserved by painting the upper side with the oil and placing them, without ironing, between newspapers and under weights to dry.

Simple Water-Distilling Apparatus

Water can readily be distilled in the small laboratory or at home by the simple arrangement shown in the illustration. An aluminum pail, filled with cold water, is suspended opposite the spout of a kettle in which water is boiling. The steam from the kettle will then strike the cold side of the pail and quickly condense. The drops of water are collected in a clean porcelain dish placed underneath. An aluminum pail is a good cooler, because this metal is

Distilling Water by Directing Steam of Kettle against Cooled Vessel

a good conductor of heat and the wall is thin. Renew the water in the pail from time to time before it gets warm. Under test, 2 oz. of water were distilled every 10 minutes with this arrangement.

Golf Practice at Sea

Lieut.-Commander Davis, chief engineer of the U. S. Coastguard cutter "Tuscarora," doesn't propose to have his golf form spoiled by his long absences from the links while at sea, so he has turned the quarterdeck into a practice course.

He took an old ball, drilled a small hole through the center, and passed a length

A Tee, a Ball, a Length of Cord and an Old Shirt Provide This Golfer with Excellent Practice at Sea

of heavy cord through the hole, knotting it at both sides. To the other end of the cord, which is 5 or 6 ft. long, is tied an old, heavy shirt. He uses a rubber tee, which can be obtained from any sporting-goods house, and this is fastened to the bulwarks with a length of light line. He can tee his ball, take his stance, and whack the ball as hard as he pleases, and the drag of the heavy shirt prevents it from going very far, while the line prevents the tee from going overside if hit.

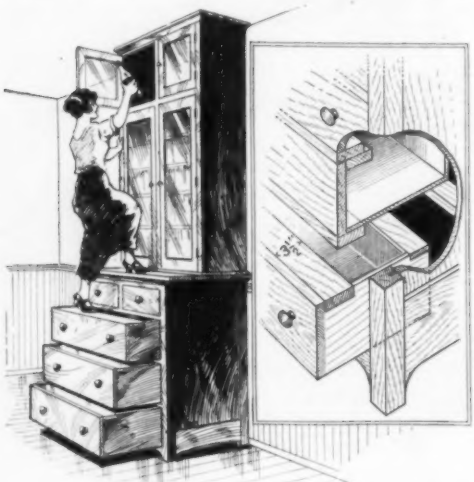
This provides fine driving practice, and the idea should prove of value not only to sea-going golfers, but also to those on shore who cannot get to the links often enough, or who wish to improve their stroke in spare moments. To prevent marring the deck Mr. Davis uses a sheet of heavy packing, placed under the tee.

Holder for Glue Tubes

Small glue tubes are hard to keep at hand on the desk or in the drawer without having some of the contents ooze out over the papers or on the surface of the desk. A simple holder, which eliminates this trouble, can be made by cutting three sides of the carton in which the tube is packed so that the upper end of the tube projects. The upper portion is then doubled over and tacked to the wall.

Steps Built on Drawers

Kitchen cupboards often extend to the ceiling and their highest shelves are good storage places but are hard to get at. Pulling out the drawers and standing on



A Permanent Stepladder for Reaching the High Shelves of a Kitchen Cabinet

the edges is both awkward and dangerous, but 3½-in. ledges provided just inside of the drawers, as shown in the illustration, make it safe to use them as a stepladder. The ledges extend across the entire width of the drawers, but are narrow so that articles kept in the latter are as easily reached or stowed away as before the change was made.—A. May Holaday, San Jose, Calif.

Preventing Choker-Wire Damage on Ford Radiator

It is usually necessary to choke the carburetor of a Ford car before starting the engine and the choker wire is almost invariably placed between the radiator tubes so that it can easily be grasped when one is cranking the engine. This wire will eventually wear a hole in the soft copper tubing and cause a bad leak, which is difficult to solder. An excellent way to prevent this is to solder a small metal pipe between the radiator tubes, so that it comes flush both in front and behind the radiator. The wire is passed through this pipe and thus can no longer rub against the radiator tubes. A small amount of lubricant may be placed in the pipe when giving the car a general greasing.—Bunyan Kennedy, McCool, Miss.

Protecting Auto Upholstery

While making repairs on closed cars, it often happens that the upholstery is soiled by the workman. To prevent this, seat covers of canvas or other heavy cloth will be found useful. The covers are made in pieces to fit over the whole upholstery, including the sides and doors, large safety pins being used to keep them in place. Car owners who do their own repair work will also find covers of this kind serviceable as a protection against grease and dirt.—G. A. Luers, Washington, D. C.

Simple Roller Coaster

A roller coaster of the kind shown in the drawing will be found to give additional pleasure to children who are fond of skating, especially if they live near a hill having a smooth sidewalk on which they can coast. The coaster consists of a 1 by 4-in. board about 3 ft. long, with half of an ordinary roller skate bolted on it at one end as shown. A seat and handle are also bolted across the board, the seat consisting of a short length of 4-in. material and the handle of a length of broomstick. The method of using the device is apparent from the drawing.—Roscoe A. Johnson, Portland, Oreg.

Inexpensive Window Shades

On several double windows in my house I used large opaque shades, about 72 in. wide, instead of a single shade for each window. These were soiled in a few months and were almost impossible to clean. As new ones were rather expensive, I decided to substitute cheaper material, light in color and washable. So I purchased 15 yd. of 72-in. bleached sheeting of good quality and cut this into five

3-yd. lengths. After hemming them at one end to receive the slats, I starched them and stretched them out to dry in the same way as lace curtains. I then ironed them smooth and tacked them to the rollers of the discarded opaque curtains. Shades made in this way are translucent, giving the rooms plenty of light. Every time the curtains are laundered I also launder the shades.

The opaque curtains previously used cost about $32, while the total cost of these homemade curtains was only $12.—Mrs. Minnie T. Miller, Wells, Nev.

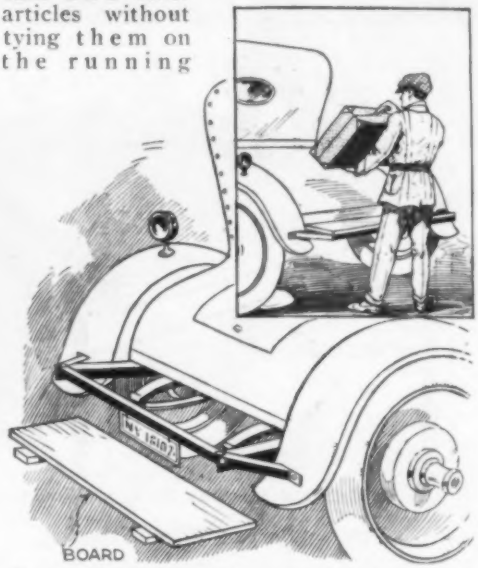
Support for Baby

When babies are just able to sit on the floor and play with their toys, but not strong enough to keep from falling over, they are usually propped up with pillows. These are, however, rather warm and uncomfortable, and it is much better to provide a support of the kind shown in the illustration. It is made from two wooden barrel hoops, a couple of slats, 2 in. wide and about 14 in. long, and a few narrow boards, 10 in. long. One of the hoops is cut open, one-third of the length cut off, and the ends joined to form the smaller upper loop. The hoops are fastened to the boards that form the backrest, with small bolts, and the 14-in. slats similarly attached to the hoops to brace the "baby sitter." All bolt heads should be countersunk so that they will not hurt the baby or tear its dress. The assembly is then sandpapered smooth and varnished, and firmly fastened, at some convenient corner, to the floor by means of two shelf brackets at the back. The upper loop holds baby upright and the lower loop gives plenty of room for its legs and playthings, which cannot roll out of its reach.—Minnie Britt Riggle, Bavaria, Kans.

Simple Support, Made from Barrel Hoops and Slats, Prevents Baby from Falling Over

Luggage Carrier for the Roadster

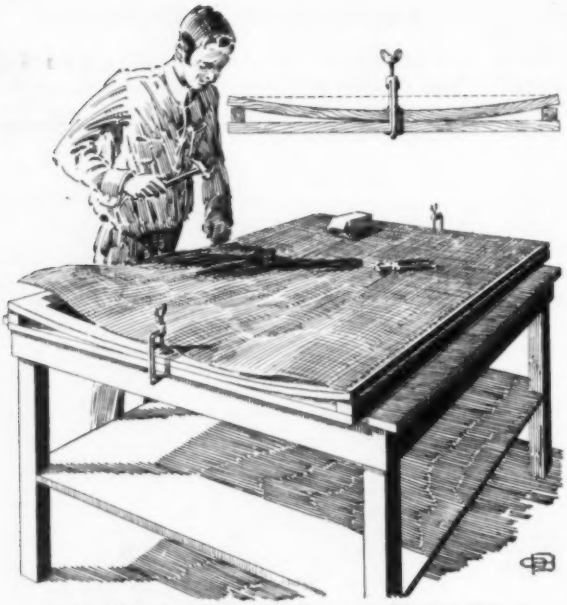
Farmers who own roadster automobiles find it difficult to carry egg cases, cream cans and other articles without tying them on the running boards. This difficulty is overcome by providing a luggage carrier of the kind shown in the drawing, which is also convenient for salesmen. Two 30-in. lengths of 2-in. angle iron are securely bolted to the frame under the rear end of the car, with the ends projecting about 15 in. Across these ends is bolted a brace of 1-in. angle iron, long enough to be bent over to permit fastening the ends to the fenders with short bolts. A piece of 1-in. board, just long enough to fit on the frame thus made, is provided with cleats, and serves as a floor on which the luggage is carried. The carrier may be enameled to match the color of the car and will support a weight of 300 lb. safely.



Homemade Luggage Carrier on Roadster Is Useful to Farmers and Salesmen

Shaving-Brush Holder

A shaving brush is injured by permitting it to remain in the mug to dry. It should be suspended with the hair down. A holder can readily be made from a piece of wire bent to form a forklike clamp, with the back-bent wire ends pointed. The clamp should fit the neck of the handle snugly, and the pointed ends are driven into the wall or other support. Or a loop may be made at each end of the wire so that the holder can be attached to the wall with two small screws.



Simple Method of Stretching Screen on Wooden Frames

Pulling Screen Wire Taut

When fastening wire screening on wooden frames, one usually has difficulty in getting the screen stretched tightly. A good method of doing this is shown in the drawing. Two strips of wood, about ¾ in. thick, are laid under the sides of the frame and the ends are drawn down on the table with C-clamps, as indicated. It is then an easy matter to tack the screen on. When the clamps are removed the screen will be tight across the frame, and the ends are then tacked without difficulty.

Finishing Colonial-Stairway Handrail

The handrails on white-enameled colonial stairways always seem to be dirty, always need cleaning, and after some time commence to look the worse for wear. All this can be obviated. A black handrail, and black-capped newel posts present a splendid appearance—look better really than the all-white stair does. But the question is then how to keep it black, and to prevent it from chipping and looking ragged. The whole secret lies in the kind of finish put on it.

If the handrail has ever been painted, take a piece of fine sandpaper and rub the rail until turpentine will "take hold." The sandpaper must be fine enough to leave the rail smooth, yet cut the paint. Dissolve enough lampblack in turpentine to make a heavy black liquid of about the consistency of water, and into this stir about 3 oz. of clear shellac, mixing it well. Too much shellac must not be used or the finish will have an undesirable gloss. Clear varnish will serve as well as shellac. When this is flowed onto the handrail it dries almost as fast as it is put on, and it does not chip off when dry. This gives a satin finish; if a gloss finish is desired more shellac or varnish may be added, but the more varnish or shellac used, the easier the finish chips off. When dusting, use a cloth with ordinary furniture polish, taking care not to leave it greasy. For new handrails, unpainted or unstained, take about ½ pt. of gasoline; into this put a small quantity of dark-oak paste filler, and sufficient lampblack to give a jet-black color. This makes a stain that penetrates the wood cells very rapidly. Flow it on, allow it to stand a moment, then rub it off. Repeat this process until the wood is as black as desired, taking care to touch up the light spots until the color is even. Now rub off all the stain that has not penetrated the wood. Polish with linseed or paraffin oil, rubbing in all that will penetrate the wood, but no more, or the rail will have a greasy finish.—G. O. Anders, W. Lafayette, Ind.

Skid-Chain Cross Links Make Door Handle

The photo shows a novel use for cross links of worn-out auto skid chains as a handgrip on sliding doors of garages and barns. They are stapled to the doors and can also be used as handles on boxes. To prevent the chains from rusting they should be given an application of paint.—Albert L. Ball, Niagara Falls, N. Y.

¶It is much cheaper for country poultry keepers to buy the grains and by-products and mix them at home.

RADIO

Broadcasts from Ocean's Bottom

HOW a diver feels and what he sees as, clad in his heavy armor, he "plods his weary way" along the ocean floor and explores the weird submarine world of gloomy lights and flickering, sinister shadows, was vividly described to thousands of radio fans not long ago when C. O. Jackson, a diver from Philadelphia, successfully broadcast a talk from the bottom of the Atlantic. To those who were listening in to station WIP he told all that he saw in his trip to Davy Jones' locker. This is the first time that such a feat has been attempted, and it afforded a real thrill to the listeners. The diver was equipped with a helmet in which was installed a microphone, protected by sponges and connected to the boat from which he descended.

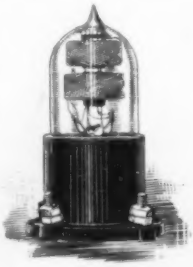
C. O. Jackson of Philadelphia Receives a Silver Cup for Broadcasting a Talk from the Ocean Floor; Below, Diver Going over the Boat's Side

The boat was connected by wire to an amplifier on the Atlantic City pier near which the experiment took place, and a land wire hooked up the pier apparatus with the broadcasting station. The first thing that the listeners heard was a swirling, swishing sound, which, it was explained, was the noise of the air currents in the diver's helmet. The voice at first was weak, but grew stronger, and when the diver had reached bottom, fifty feet below the surface, they heard him say, "On my left I see the wreck of an old boat. It looks like the skeleton of a huge fish. In it a school of little fish is playing. The rays of the sun, which look green at this depth, shine on their backs." After walking around a second wreck near by and describing its appearance, and that of the ocean floor in the vicinity, the diver ascended, having been under water ten minutes. Upon his arrival at the pier the diver was presented with a silver cup, as a memento of the occasion when the ocean's bottom was first described to those on shore direct from the man on the spot. The test was a complete success, and listeners had a variation from the usual programs.

The Microphone inside the Helmet, Protected by Sponges; Insert, "Coming Up"

Transformer Sealed in Vacuum

Experimenters have long realized the advantages of the air-core transformer for maximum amplification at a given wave length, but it has heretofore been found impossible to construct transformers of this type that could be depended upon to give uniform and satisfactory results under all conditions. Absorption of atmospheric moisture in untreated coils causes serious losses, and treatment of the coils with gums and resins to remove this difficulty introduces another set of losses equally serious. Now, it is claimed, these difficulties have been overcome by a transformer sealed in a vacuum tube. The coils are thoroughly dehydrated and accurately spaced on a glass rod, then inclosed in a tube of high-lead-content glass, evacuated to a high degree and sealed. The initial efficiency of the transformer is thus retained.



One Antenna for Several Sets

By connecting a "coupling-tube unit" devised by U. S. naval radio experts, it is possible to hook several receiving sets onto a common aerial and each set can receive signals on a different wave length without interfering with the other sets. The apparatus has been thoroughly tested and found successful on board the U. S. S. "Colorado"; the ship's operators copied simultaneously several messages from different stations even while the battleship's transmitter was in action, thus enabling the vessel to carry on several times the normal amount of business.

The unit includes a resistance so high that the strength of incoming signals is reduced considerably, and it is therefore necessary to use receiving sets with three or four tubes. A radio-frequency step in the form of a trap, which eliminates regeneration, is required and a receiving set using a detector tube. This unit has become part of standard battleship equipment. To the general public this device is also of considerable usefulness as it will eliminate the great number of aerials found on city apartment buildings.

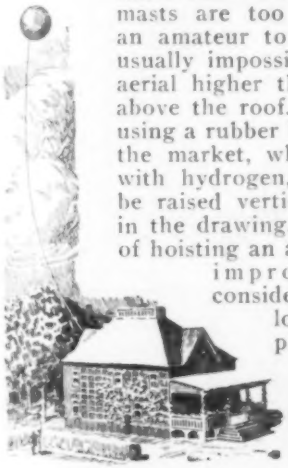
Connecting a B-Battery Switch

In connecting a variable B-battery to a multiple-point switch so as to control the voltage from the front of the panel, there should be twice as many contact points as there are taps on the battery, every alternate contact being dead.

This will eliminate the shorting of the cells of the battery that takes place when every contact is connected to a tap, and the switch lever, in passing from one to another, momentarily makes contact with both. As B-batteries are of low amperage, this shorting reduces their life considerably.—D. G. Tiffany, Palo Alto, Calif.

A Balloon Aerial

It is a well-known fact that a high aerial adds to the volume of reception on any radio set. Towers and high masts are too expensive for an amateur to build so it is usually impossible to have an aerial higher than a few feet above the roof. However, by using a rubber balloon now on the market, which is inflated with hydrogen, an aerial can be raised vertically as shown in the drawing. This method of hoisting an aerial, it is said, improves reception considerably. The balloons for this purpose are made in different sizes and the hydrogen can be obtained in tanks or it can be generated from iron and sulphuric acid. Common illuminating gas can also be used for inflating the balloon but this gas does not possess so much lifting power as hydrogen.



Railroad Plans to Dispatch Trains by Radio

A number of tests have recently been made by members of the American Radio Relay league and the staff of one of the eastern railways, to determine the practicability of using radio in stormy weather emergencies for dispatching trains. It is said the tests showed the scheme practical, and that radio will soon be installed for this purpose.

It is planned eventually to conduct all dispatching by radio.

Setting Clock by Radio

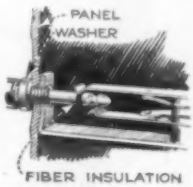
A new advance in radio has been made with the setting of a timepiece at the bureau of standards from the Arlington broadcasting station. The setting of this clock was made possible by means of a radio-relay mechanism, worked in conjunction with a series of retardation relays so that the dots sent during the radio time transmission do not operate the clock-setting mechanism, but the dash at 12 o'clock (noon) or at 10:00 p.m. will perform this operation. H. J. Walls, assistant radio engineer at the bureau, devised the retardation relays.

Copyright, Underwood & Underwood

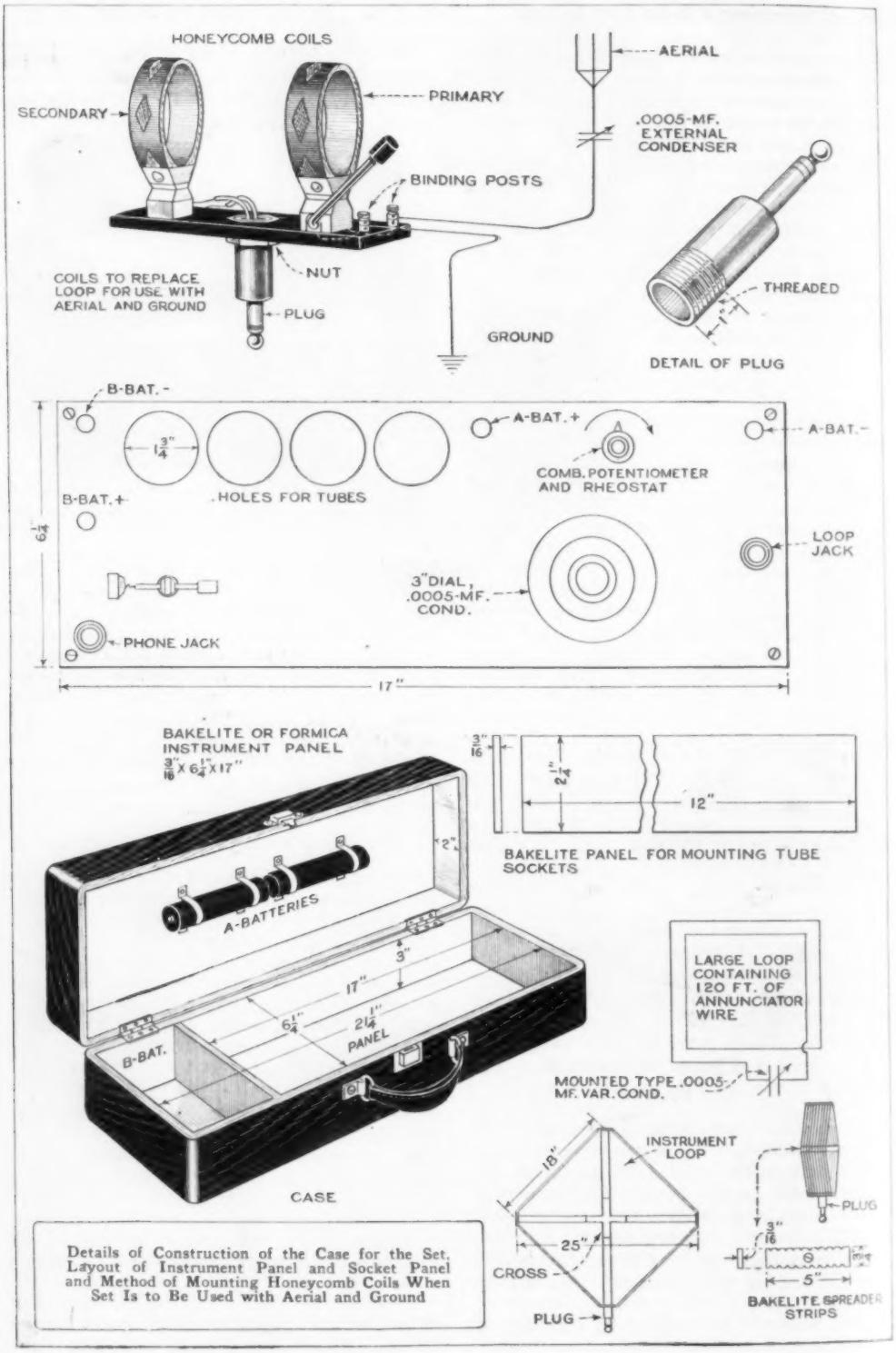
Clock Wired for Automatic Setting by Radio, and Inventor of System

Making Phone Jacks Fit Properly

It sometimes happens that a phone or loud-speaker plug is too short for the jack provided on the radio set, and this causes the fiber insulating ring on the plug to come directly under one contact of the jack, with the result that the phones fail to function. The remedy is either to remove the washer behind the threaded bushing on the plug or to move the jack contacts forward, which is possible with some jacks by loosening a screw on the underside. It is a good idea to examine both plug and jack carefully before soldering the wires, in order to prevent trouble of this nature.



¶ Cold-water pipes usually make better grounds than steam pipes or radiators.



Details of Construction of the Case for the Set, Layout of Instrument Panel and Socket Panel and Method of Mounting Honeycomb Coils When Set Is to Be Used with Aerial and Ground

BUILDING A PORTABLE REFLEX RECEIVER

By F. L. Brittin

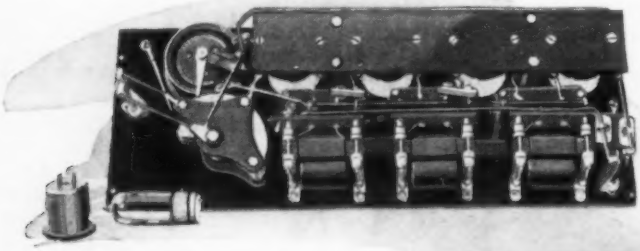
THE receiver described in this article represents a set of very high efficiency, in which four tubes do the work of seven. It has great flexibility, as it can be used both as a portable and a stationary set. It has only two controls, which means simplicity in operation, and it does not squeal, which means a great deal to those who have heard the noise produced by the majority of the apparatus now in use. The use of the loop eliminates static to a remarkable degree, as well as interference from other stations and squeals from the neighbors' sets. The instrument is simple to build and the cost is low considering the results obtained. Standard tube sockets are used, and, by using adapters, any type of tube can be utilized. For portable use, either the UV-199 or C-299 tubes are suitable; these operate on but 1½ volts and draw only .06 amp. The instrument is designed to operate on a 2-ft. loop, and will bring in on this stations up to 1,000 miles distant. By using honeycomb coils plugged in instead of the loop, much greater distances can be covered with an ordinary aerial and ground. The wave-length range is from 200 to 600 meters.

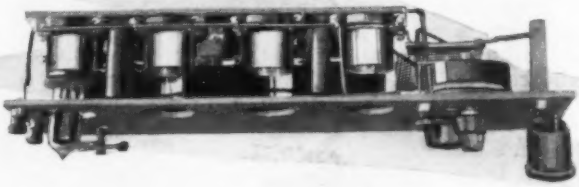
The Complete Portable Reflex Set in Use: This Set Has a Remarkable Range and Is Simple to Build

The inside dimensions of the case are 21¼ by 6¼ by 3 in., with a partition set 4 in. from one end for the B-batteries. The wood used may be selected in accordance with the desire of the builder; poplar does very well, and the stock can either be ⅜ or ½ in. thick. The lid, which is 2 in. deep is hinged to the case, and it will be noted that the dry cells forming the A-battery are strapped to the inside of the lid. These are two three-cell French No. 1027 flashlight units; the zinc bottoms of the cases are butted against a little brass angle as shown in the full-page diagram. The angle is screwed to the inside of the lid, and the negative lead soldered to it. Small brass angles are also used to form the positive connection, and are bent so as to make good contact with the center electrodes of the cells. By mounting the batteries in this way they can easily be removed when completely discharged and new ones substituted. If one cannot construct the case at home, any good cabinetmaker will do the job for a reasonable sum. It should be fitted with rubber feet to prevent marring the surface of any article of furniture on which it may be set, and should be provided with a neat nickeled handle and lock. Poplar takes a good dark-oak finish,

while, if birch is used, it is possible to finish it to resemble mahogany closely. Use a good spirit stain and filler, then apply several coats of varnish, rubbing down between coats with powdered pumice, or rottenstone, and oil until a good smooth surface is obtained.

In the reflex circuit some of the tubes are used twice, once as a radio-frequency amplifier and once as an audio-frequency amplifier. The advantage of this can be seen at a glance, as great amplification can be obtained with a small number of tubes. A crystal detector is used to insure a good tone quality without distortion; the one used in this set is of the synthetic-mineral type, a number of which are to be found on the market. In this set the tubes are mounted on a small panel fastened to the main one by means of four hard-rubber rods, ½ in. in diameter and 2½ in. long. These are drilled and tapped at each end for small machine screws, which bind them to the panels. The rods can be seen clearly in the photo showing the "works" removed from the case. The socket panel is 12 by 2¼ by 3/16 in. in dimensions. It is advisable, before beginning the actual construction of the set, to study the diagrams carefully and to note the position of every instrument. A good deal of trouble was encountered in the layout of the original set, and, while this is now worked out for the reader, a little study will make the job of mounting the instruments much easier.

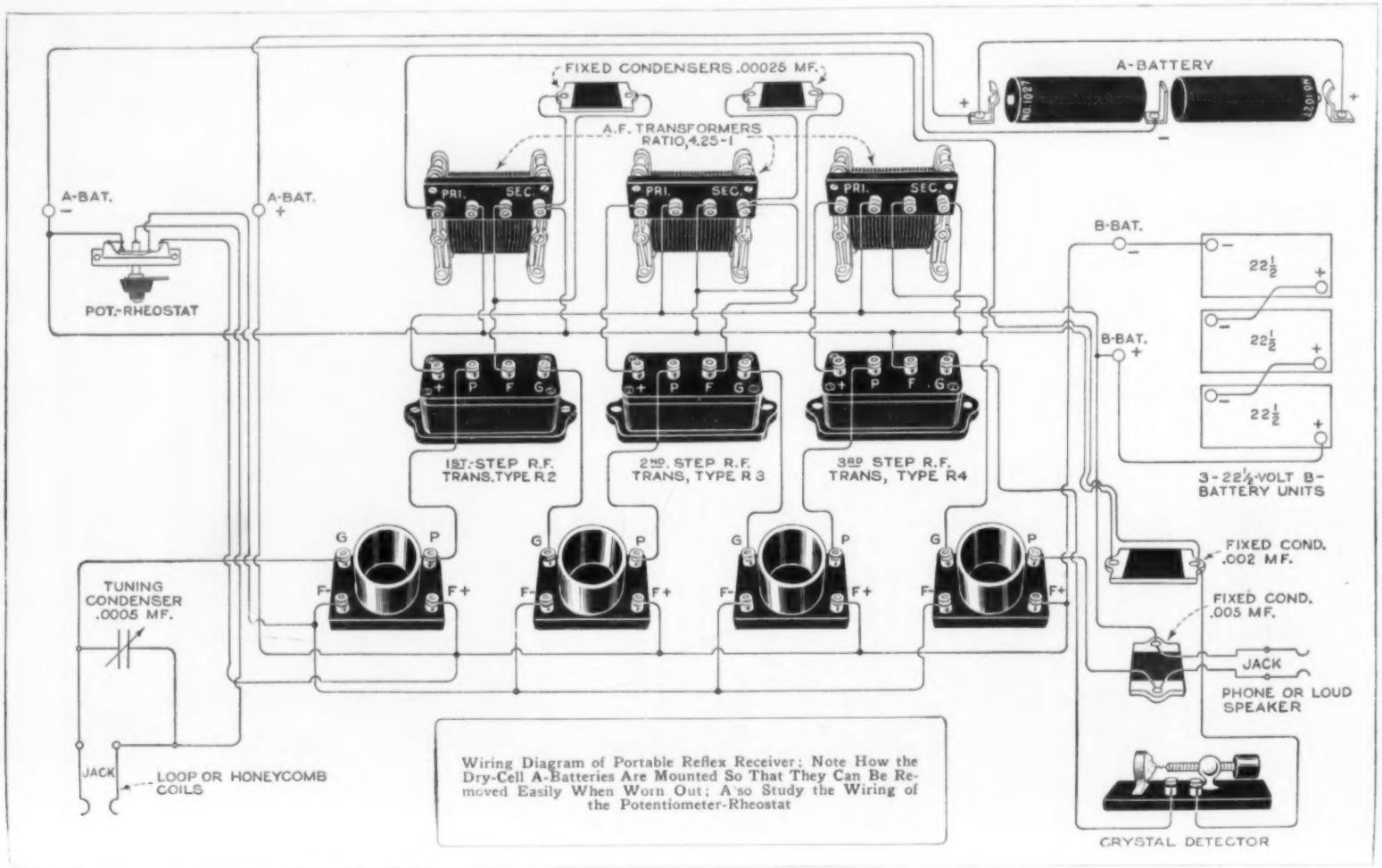




Bottom and Side Views of the "Works" of the Portable Reflex Receiver; Note the Rubber Rods That Support the Socket Panel, in the Side View

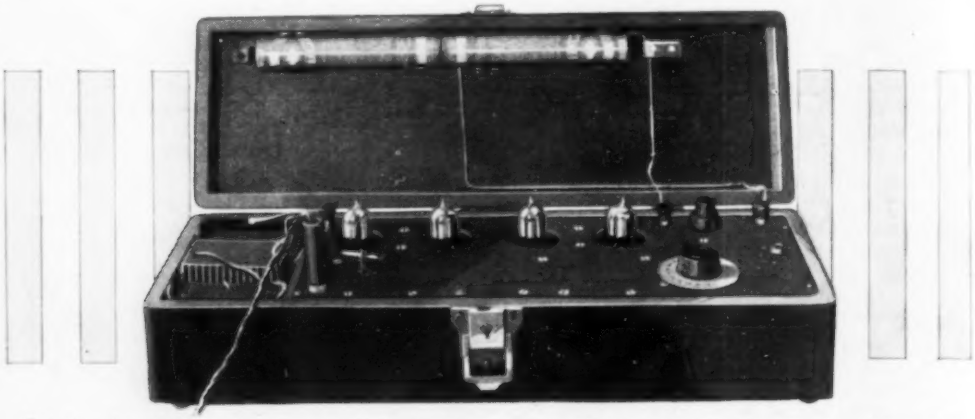
The instrument panel is made of formica or bakelite and is 17 by 6¼ by 3/16 in. in size. The holes for the tubes are 1¾ in. in diameter and are easily laid out from the small panel. A combination rheostat and potentiometer is mounted in the back right-hand corner; this controls all tube filaments, and is correct for all tubes drawing not over .3 amp. If tubes drawing more than this are used, it is advisable to have separate rheostats for each tube. It will be noted that the potentiometer is connected across the A-battery, the potentiometer lever being connected to one side of the loop jack; the rheostat is connected in series with the A-battery in the usual manner. The A-battery binding posts are mounted on either side of the potentiometer-rheostat. Just below the latter the .0005-mf. tuning condenser is mounted on the panel; this is connected across the loop jack, which is placed to the right of the condenser. The loud-speaker or phone jack is placed at the left front of the panel and the crystal detector mounted just above it. To the rear of these the B-battery binding posts are fitted, in a convenient position for connecting to the batteries in the compartment at the left of the case. Holes are drilled in the instrument panel for the transformers, which are screwed to it upside down. These are grouped as shown in the photo of the bottom of the set, to get them as close as possible while preserving the layout shown in the circuit diagram; this permits the leads to be made short, which is necessary for efficiency. The audio-frequency transformers all have the same ratio—4.25 to 1; the radio-frequency transformers are the Acme types R-2, R-3 and R-4, which are specially designed for circuits of this character.

The fixed condensers are of the mica type. One .00025-mf. condenser is used across the secondaries of each of the first and second audio-frequency transformers and one .002-mf. condenser as a by-pass for both high and low-frequency currents, to prevent howls and high-frequency losses. A .005-mf. condenser is connected across the phone or loud-speaker jack. All connections must be carefully soldered, using small copper or brass soldering lugs



Wiring Diagram of Portable Reflex Receiver; Note How the Dry-Cell A-Batteries Are Mounted So That They Can Be Removed Easily When Worn Out; A so Study the Wiring of the Potentiometer-Rheostat

under the instrument terminals. Acid-core solder must not be used, as there is danger of corrosion, leading eventually to broken connections. Use resin-core solder, or plain wire solder with a resin flux, and only enough solder to make a good connection. All leads should be as short as possible, and should be of No. 14 or 16 tinned copper wire, covered with a good grade of yellow varnished-cambric tubing; don't use the black "spaghetti" tubing, as this is sometimes varnished with a compound containing lampblack, which causes a great deal of "mysterious" leakage, sometimes causing the instruments in which it is used to stop functioning.



The Complete Set, Showing A and B-Batteries in Place and with Loud-Speaker Plug In, but without the Loop, Which Is Plugged In at the Right

The loop is very easy to make, and the dimensions given should be followed closely to obtain the best results. Brass tubing, cut and soldered in the form of a cross, or a brass-pipe cross fitting, if this can be obtained, is used for the center; ½-in. dowel stock is used for the arms, which are each 11½ in. long. A spreader strip of bakelite, 5 by ¾ by 3/16 in. in size, is screwed on the end of each arm, and 10 turns of No. 18 flexible annunciator wire wound on the loop. The ends of the wire are brought to the terminals of a common phone plug, which is fastened to the bottom stick of the loop with a wooden pin. The loop is now ready for use, and is simply plugged into the loop jack on the panel; this allows the loop to be turned in any direction for tuning to a particular station, while maintaining a good connection. A new and very effective method of increasing the range and selectivity of a small loop is to place 120 ft. of insulated annunciator wire around the picture molding of the room in which the instrument is used, or on the wall, in the form of a 1 or 2-turn loop and connect a .005-mf. variable condenser across the terminals of the wire. The large loop has a greater pick-up than the small one, and the coupling between it and the small one attached to the instrument is so loose that very close tuning is possible. When this large loop is used, tuning is done with both the condenser on the instrument and the one on the large loop.

For use with a regular aerial and ground, the instrument is fitted with 35, 50 or 75-turn honeycomb coils. A stationary and a movable mounting for the coils are fitted to a bakelite strip, 6 by 3 by 3/16 in. in dimensions. An ordinary phone plug with screw connections is used and the fiber or bakelite shell threaded for a

MATERIAL LIST

1 bakelite panel, 17 by 6¼ by 3-16 in.
1 bakelite panel, 12 by 2¼ by 3-16 in.
1 bakelite panel, 6 by 3 by 3-16 in.
1 case to dimensions given in drawing.
4 hard-rubber rods, 2½ by ½ in.
4 tube sockets.
3 a. f. transformers, ratio 4.25 to 1.
1 each r. f. transformers, Acme R-2, R-3 and R-4.
4 binding posts.
1 comb. potentiometer and rheostat.
1 .0005-mf. variable condenser.
2 .00025-mf. fixed condensers, mica type.
1 .002-mf. fixed condenser, mica type.
1 .005-mf. fixed condenser, mica type.
2 single-circuit jacks.
1 detector, synthetic-mineral type.
3 B-battery units, 22½ volts, small type.
2 flashlight batteries, French No. 1027.
1 3-in. condenser dial.
4 UV-199 or C-299 tubes.

Two lengths, varnished-cambric tubing; tinned-copper wire, wood screws, terminal lugs, machine screws and flat brass sheet for A-battery connections

sufficient length to go through the strip and take two pipe nuts to fasten it securely. Two binding posts are mounted on the end of the strip and the connections from the aerial and ground taken through the posts to the secondary coil. The plug is connected to the primary coil. This device is plugged into the loop jack when it is desired to use a regular aerial.

Instead of the loop, a small honeycomb coil can be plugged into the loop jack, and this is sufficient to bring in near-by broadcasting stations on a loud speaker, but the use of the loop described is, of course, advised in all cases.

The best tube of the four should be used in the socket nearest the loop jack; this is the important stage of the instrument. The operator will be able to select the best tube for this position by trial.

Unusual Weather Conditions Not Radio Fault

The unusual weather conditions prevailing this summer have been attributed to radio broadcasting, by someone with more or less authority to speak. This idea seems to have spread pretty generally over the country, and, ridiculous as it is, the idea supplies a new goat on which to blame the weather conditions.

Radio broadcasting is a new science, and there are many unsolved mysteries yet to be clarified by time and experience; this makes it very easy for the semi-scientific analyst to make sage announcements that will not hold when viewed in the light of truth, with reasoning based on common sense and a knowledge of the principles involved.

It is a popular belief that a large amount of electrical energy is released by the average radio broadcasting station. This is not the fact. We will consider the 500-watt station; one flash under a trolley wheel, lasting .01 of a second, will release more power in actual electrical high-frequency radiation, than the average 500-watt broadcasting station will in one hour of continual operation.

Every arc light in the streets, or an arc light, such as used in the moving-picture industry, radiates many times as much energy as a 500-watt broadcasting station, and it is the same type of radiated high-frequency energy used in broadcasting. It is plain to see that radio furnishes a very small part of the high-frequency energy roaming around in our atmospheric envelope. The average flash of lightning between clouds and the ground will radiate more energy than all the combined radiophone broadcasting stations and commercial wireless stations in the world will radiate in years.

Unusual weather conditions cannot be explained through any agency produced by man; we seek a reason through some phenomena we do not understand, and choose one that offers the least resistance to the popular mind.

A Thirty-Cent Radio Set

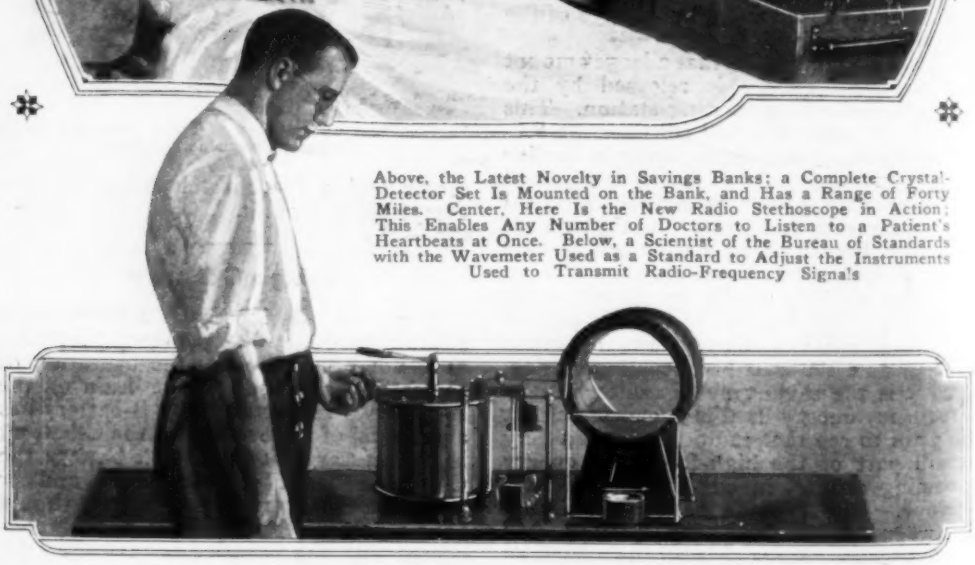
At the cost of only thirty cents, the radio set shown in the photo is doing day and night duty in the elevator-control room of a skyscraper. It was made from a sawed-off curtain pole, wound with wire to form an inductance, and nailed to a baseboard; a sliding contact was arranged for tuning. A simple condenser, consisting of sheets of tinfoil flattened and held in wax envelopes, an ordinary crystal detector and a 75-ohm telephone receiver completed the outfit.

Receiving Set Built at Cost of Thirty Cents and Using Ordinary Telephone Receiver

Using a C-Battery

The C or bias battery is a very useful adjunct to the audio-frequency amplifier, as it not only improves the operation of the set but also reduces the drain on the B-battery. However, if the B-battery has a potential of under 45 volts, the C-battery is unnecessary; for a 60-volt battery the C-voltage should be about 3 volts, and for a 90-volt B-battery the C-battery should have a potential of 4½ volts, and be connected with the negative toward the grid.

Above, the Latest Novelty in Savings Banks; a Complete Crystal-Detector Set Is Mounted on the Bank, and Has a Range of Forty Miles. Center, Here Is the New Radio Stethoscope in Action; This Enables Any Number of Doctors to Listen to a Patient's Heartbeats at Once. Below, a Scientist of the Bureau of Standards with the Wavemeter Used as a Standard to Adjust the Instruments Used to Transmit Radio-Frequency Signals



Lower Photo Copyright, Henry Miller Servi

Above, the World's Smallest Loud Speaker; It Weighs Only Seven Ounces, but Works Perfectly. Center, the Babies' Band of Immanuel Sisterhood, Which Has Delighted Thousands of Radio Fans; the Oldest Is Only Seven and the Youngest Three and a Half Years. Below, the "Solemn Old Judge" of WLS, with His Famous Locomotive Whistle

Lower Photos Copyright, Underwood & Underwood

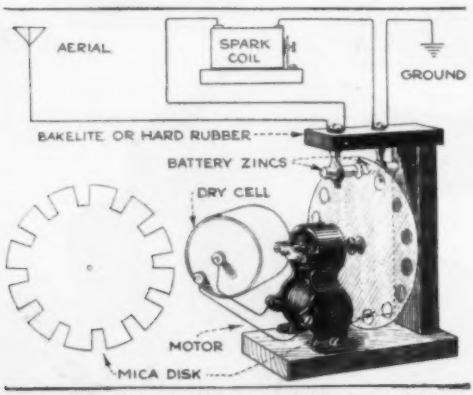
French Engineers Produce Novel Loud Speaker

The object shown in the photo looks at first glance like an accordion-pleated fan, but it is really a new and very effective form of loud speaker, designed and built by French engineers. Radio engineers have long realized that the horn type of loud speaker was far from satisfactory, although it apparently gave excellent results. It lacks the ability to reproduce both high and low frequencies with equal tonal qualities, and it may eventually be displaced by the type shown, which, it is said, overcomes all the disadvantages of the other type. The loud-speaking unit used is connected by means of a pin to an accordion-pleated paper cone, which forms the actual diaphragm or amplifier. All the low notes on a piano or other instrument which the ordinary loud speaker loses are, it is claimed, reproduced beautifully with this instrument.

A Loud Speaker That Reproduces High and Low Notes with Equal Clarity

Small Rotary Spark Gap

A considerable amount of energy is ordinarily required to revolve a heavy spark-gap rotor. A small dry-cell motor, which runs fast enough for the purpose, cannot rotate a flywheel without lessening the speed to a great extent. However, such a small motor can be used if it is fitted up as shown in the illustration.



Spark Gap Made by Mounting Thin Mica Disk on Shaft of Dry-Cell Motor

A thin mica disk, about 4 in. in diameter, with a number of ⅜-in. holes drilled at equal distances along the edge, is fitted on the shaft. If it is impossible to drill holes, notches cut in the edge will do just as well. Two electrodes, cut from a wet-cell battery zinc, are mounted on a piece of bakelite or hard rubber and supported in the position indicated. The motor can readily revolve the mica disk at a speed almost equal to its normal speed under no load. The wiring diagram of the spark coil, aerial and ground is also shown.—E. J. Bachman, Fullerton, Pa.

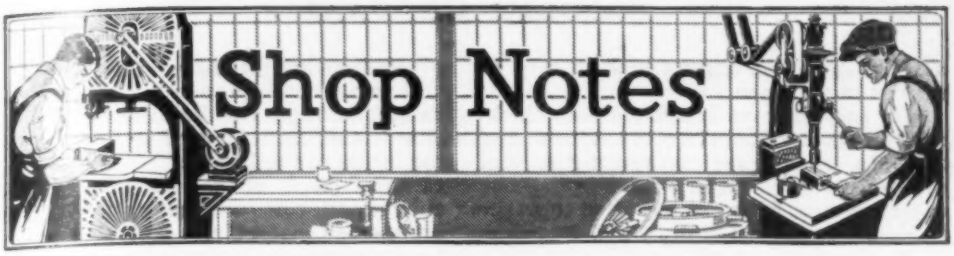
Battery Tips

Use a battery of a size adequate to the needs of your particular set. It is possible to get results from multiple-tube apparatus with the smallest size of B-battery, but the experiment will be costly because of the rapid depreciation of the current supply and the consequent need of frequent renewals. The number and type of tubes, as well as the range sought, should determine the size of the battery required.

Be sure that the B-battery is not connected to the A-battery terminals, as the tube filament is designed to operate on low voltage, whereas the voltage of the B-battery is many times that of the filament-voltage rating.

Use no more tubes than are sufficient for the results desired. It frequently happens that inexperienced operators will have more tubes burning than are necessary, and then detune to lessen the volume of sound. For local stations, for instance, the first audio stage is ample.

Burn your tubes at the lowest point compatible with good reception. Excess filament current not only drains the batteries unduly, but reduces the life of the tubes. Once the rheostat is fixed at the proper point, it should not be touched again. Turn off the filament the moment you stop listening. Current is flowing as long as the filament is lighted.



All Shop Notes published in 1923, in book form—Fifty Cents—from our Book Department

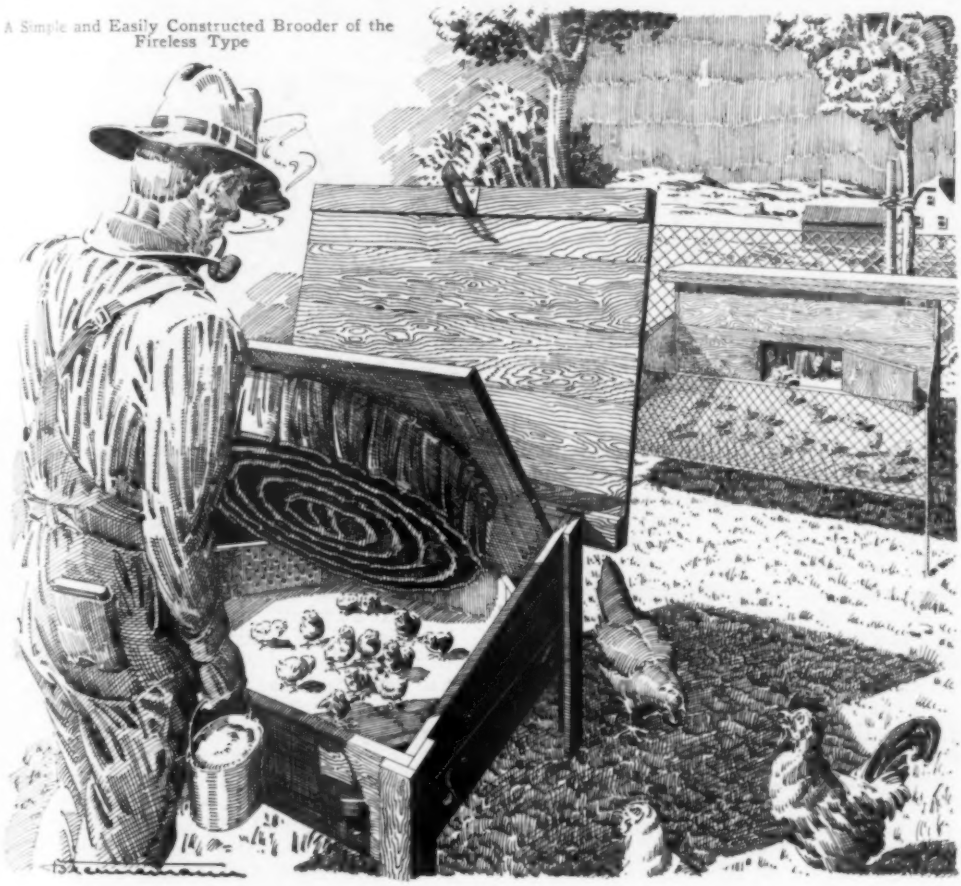
How to Make a Fireless Brooder

By J. V. ROMIG

ONE of the first and most necessary things to have after chicks have been hatched or purchased is a brooder. The poultry farmer starting in can save considerable expense by making his own; the construction is not by any means difficult, and anyone at all handy with tools can make a very efficient and creditable piece of equipment by proceeding according to the directions given in this article.

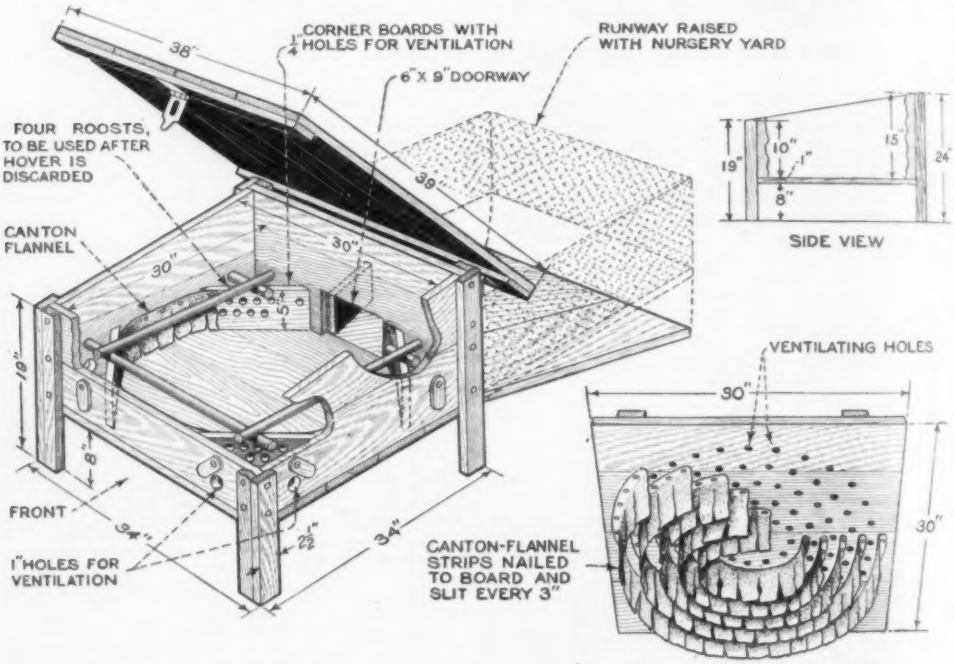
The brooder is of the fireless type, in which use is made of the principle of conservation of body heat rather than of supplying heat from an outside source. This is effected by the use of a hover board which is hung with canton-flannel strips, under the folds of which the baby chickens can nestle. It can be used both inside and outside, but it is preferable to keep it for the first ten days of the chicks' lives in

A Simple and Easily Constructed Brooder of the Fireless Type



a warm building, after which it may be set out in the open.

Old packing-case boards of 1-in. thickness can be used for the sides, bottom and roof, and if they are of the tongued and grooved variety so much the better. The outer housing, or frame, is nailed together as shown in the detail drawings, and then short pieces of board are drilled with a number of ¼-in. holes and nailed across the corners of the inside of the housing. pivoted covers fitted over them. The air will enter through these holes and percolate through the holes in the corner boards and in the hover board, ventilating the inside of the brooder thoroughly. The canton-flannel strips should be wide enough to rest on the bottom of the brooder, so that a direct draft cannot blow through it. In warm weather, the top can be lifted and blocked up, to allow more air to reach the inside of the brooder.



Details of the Homemade Fireless Brooder; Note the Hinged Runway, Which Serves as a Nursery Yard, and the Roosts for Use When the Chicks Outgrow the Brooder

Around the octagonal inclosure thus formed, a strip of heavy canton flannel is tacked, the tacks being driven around the upper edge. This strip is then slit every 3 in. nearly to the top edge; it should not be tacked completely around the inclosure, an opening being left at the back, where the door is cut in the housing.

The hover board is made slightly smaller than the inside of the brooder, so that it will rest on the corner boards and can be easily removed for cleaning. It is 30 in. square, and ¼-in. holes are drilled in circles through it, as shown. Strips of canton flannel are then tacked to the underside, so that a circle of holes will come between each pair of strips, and the strips are slit every 3 in. in the manner previously described. Two 1-in. holes are drilled in each corner of the housing, and little

As the chickens grow taller, blocks can be placed under the hover board to accommodate them. After they have outgrown the necessity for the brooder, the hover board is removed, and a four-pole roost substituted.

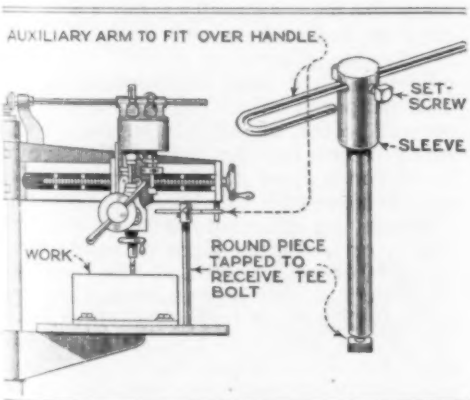
A 6 by 9-in. opening, fitted with a door, is cut in the back of the brooder housing, and a runway, the full width of the brooder, hinged just below the door. This can then be raised when the chicks are too small to be allowed to run in the yard and surrounded with chicken netting to form a perfectly safe nursery yard.

¶A convenient bench knife can be made from the broken blade of a jackknife by flattening one end of a piece of brass tube of suitable diameter and soldering the blade into the flattened end.

Stop for Radial Drill

For many kinds of work the stop shown in the drawing is a real timesaver on a radial drill. With the aid of this device it is possible to duplicate double holes in any number of pieces with the same accuracy as by using a jig. The parts required are a piece of round stock, tapped at one end to screw onto a bolt in the T-slot of the drill table, and fitted with a sleeve at the other end. The sleeve is tapped on opposite sides for setscrews and a hole is drilled through it to take an auxiliary arm, also made of round stock and bent to a hook shape as shown, to engage the handle by which the drill arm is swung. The parts are assembled as shown to the right in the illustration.

This stop was used successfully in the production of a number of pieces requiring two holes, the centers of which had to be located exactly alike in all the pieces. The adjustment of the stop was made as follows: A sample piece with holes already drilled was bolted in place. By swinging the drill arm backward and forward and lengthening or shortening the auxiliary arm, the drill was made to stop over the holes as the drill arm reached the end of its swing on either side as determined by the stop. The sliding auxiliary arm and the saddle carrying the spindle were then locked, and the work was drilled and reamed with very accurate results.—Harry Moore, Montreal, Can.



Device on a Radial-Drill Press Allows Duplication of Holes as Accurately as with a Jig

Water Heater for Contractors

The drawing shows a novel and serviceable heater for running water, that will prove useful to contractors who have to heat large quantities of water for concrete or plaster work. The heating unit consists of a number of lengths of pipe connected with elbows as shown, the bottom end being connected to the water supply and the upper end having an extension with a faucet attached. A fire is built inside of the coil and this heats the water in a short time. This heater is inexpensive to build and is light in weight, so that it can be easily moved about from one job to another.

Novel Contractors' Water Heater That Is Inexpensive to Make and Convenient to Move

Filling In Broken Enamel

Fine sealing wax is good for filling in cracks or broken spots on enameled surfaces, as it hardens at once, takes color without absorbing the oil and does not shrink. Use a wax of the proper color to match the surface to be repaired, fit it in, and smooth the surface down with a hot palette or putty knife. Give it one or two coats of color to make it match the remainder of the enamel exactly, and then varnish.

Tray for Beeswaxing Screws

Woodworkers and others who are accustomed to dip wood screws in beeswax to make it easier to drive them into the wood, will appreciate the usefulness of the dip-

Handy Dipping Tray and Dipper for Beeswaxing Wood Screws

ping tray and dipper shown in the drawing. The tray is made of sheet metal, bent over and riveted so that it is 1 in. deep, and stands on legs about 6 in. high. The wax is placed in the tray and melted by means of a Bunsen burner or small alcohol lamp. A dipper is used to hold the screws; this is made from a piece of sheet metal, having a number of slots cut to form tines, which hold the screws as indicated in the detail. The screws are picked up simply by running the dipper through a box of the screws.—Vernon F. Clayton, Detroit, Mich.

Worn Paving Brick Make Manholes

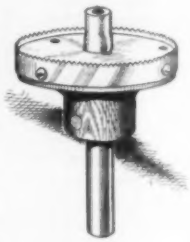
Bricks from worn-out street pavements need not be hauled to the city dump as worthless. They can be used in building manholes. For this purpose discarded bricks are just as good as new ones, because, in manhole construction, the spaces between the bricks, no matter how ragged, are filled with cement mortar. Such manholes will obviously cost much less than those built with new brick or concrete, and are practically as durable.—Ivan E. Houk, Denver, Colo.

Testing Crankshaft for Cracks

When overhauling the engine it is desirable to examine the crankshaft for cracks. Some cracks may be visible to the eye, but in most cases a crack is too fine to be seen, yet, if ignored, it will gradually increase in size until the shaft breaks—hence the importance of finding hair cracks. A simple method of making such cracks visible is to suspend the shaft from one end by means of a rope and then strike the crank cheeks in turn a sharp blow with a hammer. The vibration forces oil out of the crack and the shadow of the fine oil line is distinct on the clean surface of the shaft. Any crankshaft found to have a crack in it should be discarded.

Cutting Circular Holes in Sheet Metal

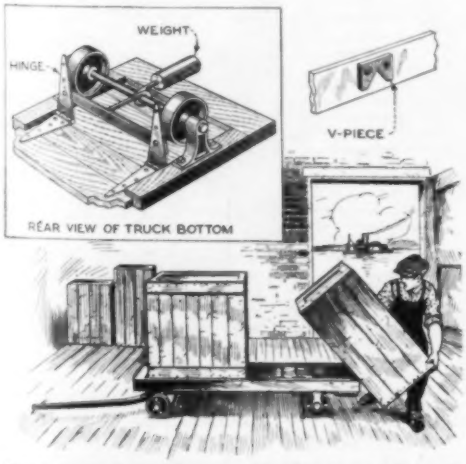
It is often necessary to cut circular holes in instrument boards for speedometers, clocks, etc. This cutting cannot be done very well with an ordinary saw, and therefore the circular saw shown in the photograph was made. It consists of a hacksaw blade screwed to the edge of a circular piece of wood, and the shank of an old drill bit. The piece of wood is turned down to a suitable diameter and ½ in. wide, with a boss about 1½ in. in diameter in which the drill shank is pinned. The material should be hardwood, such as oak, as it must withstand considerable strain. A thin, flexible hacksaw blade is bent around the edge and both ends of the blade are cut off so that the ends fit together exactly. The temper is taken out of the blade at several points, about 2 in. apart, so that screw holes can be drilled through it. Small round-head screws are used to fasten the blade to the disk. A hole is drilled through the center to receive the drill shank, or a similar piece of round steel, about ⅜ or ½ in. thick and 4 or 5 in. long. The shank should project beyond the saw teeth so that it will serve as a center guide, which is inserted into a small hole drilled first. A ⅛-in. hole is drilled through both boss and shank, and a nail is driven through to serve as a pin, the ends being flattened to keep it in place. By grinding out a number of the teeth at intervals along the edge it will be easier to turn the tool, if it must be used in a hand brace or drill.



Brake for Shop Trucks

When loading hand trucks with heavy boxes it is usually necessary to slide them onto the truck, and the latter must either be held by another person or the wheels "scotched" with blocks to keep the truck from moving. Recently a small plant fitted the shop truck with a brake as shown in the drawing, and the truckman is now able to load it alone without blocking.

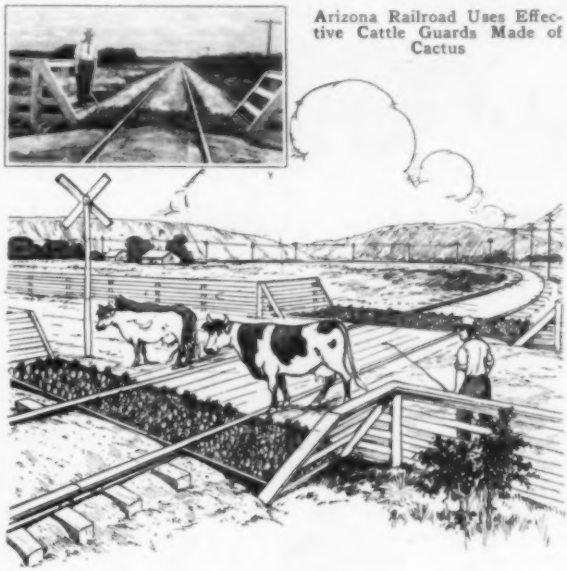
The attachment is easily made; two strong hinges are fastened to the underside of the truck in front of the rear wheels, one end of each hinge being allowed to hang loose. The loose ends are connected by a strip of heavy sheet metal, which is fastened to them with screws. In the center of this strip is riveted a V-shaped piece of metal to act as a catch for a piece of round rod which is bent around the axle of the rear wheels. The part of the rod between the axle and the V-piece should be so long that it will tilt the loose leaves of the hinges a trifle forward, holding their lower ends above the floor. At the other end a cylindrical weight is driven on the rod. When the truck is to be loaded, the weight is lifted with the foot, which allows the hinges to drop into contact with the floor. The truck is then given a forward push, causing the hinges to bring up against the rear wheels and raise them a little, so that the truck is securely blocked.—Harry Moore, Montreal, Can.



Brake on Factory Truck Enables Worker to Load It without Blocking Up the Wheels

Cattle Guard Made of Cactus

A section foreman on an Arizona railroad conceived the idea of using cactus plants for a cattle guard at railroad crossings. The first one he built proved so successful that the railroad company decided to use his method exclusively. The guard consisted of a wooden frame of 2 by 6-in. material under the tracks, as shown in the drawing. In this boxlike structure, sand and gravel were placed to a depth of a few inches and the cactus planted in it. As the cactus used for this purpose grows in abundance along the railroad these guards cost nothing outside of the wood and labor to construct the frames. That it is also efficient is shown by the fact that during the first six months not a single animal attempted to cross it. Both horses and cattle in this region are familiar with the sharp thorns of cactus and avoid it as they would a rattlesnake.—Robert H. Moulton, Chicago, Ill.



Arizona Railroad Uses Effective Cattle Guards Made of Cactus

Keeping Record Map Up to Date

A wall map in the office of an electric-light company was used to indicate the changes and extensions in the overhead lines. It was at first found difficult to make the alterations on the map satisfactorily, but all trouble was overcome by placing it in a picture frame having a glass front and indicating the changes on the glass with various colors of waterproof ink.

Movable Workbench

In an automobile repair shop in western Maryland the writer observed a small repair table, made from an old steel oil drum and mounted on casters so that it could be

Sturdy Workbench Made from Oil Drum and Mounted on Casters

moved about. A wooden top was bolted on the drum, and on this top a small vise and hand grinder were mounted. A semicircular opening was cut in the side of the drum so that oilcans, greasing equipment, waste and various tools for tire and other repair work could be stored when not in use. Casters were riveted to the side near the bottom, as indicated in the detail. Obviously, the use of this table saved many steps to and from the workbench and thus eliminated waste of time. It was possible even to put an engine on this sturdy table and move it to another section of the shop.—G. A. Luers, Washington, D. C.

Efficient Drawing-Pen Cleaner

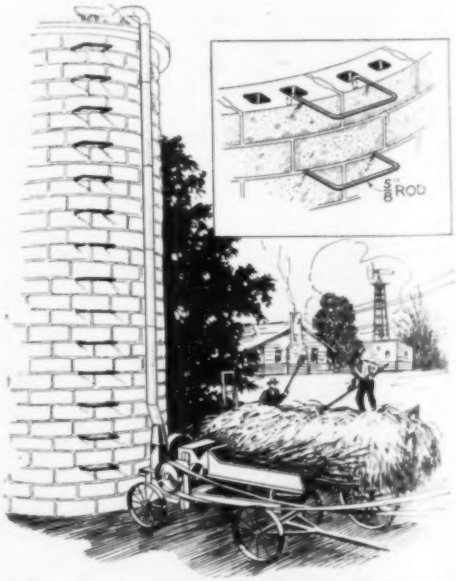
Drawing pens and pens on compasses can be cleaned easily with an ordinary pipe cleaner. The cleaner is bent to form a loop, the ends being twisted together and inserted in an improvised handle. The loop is brought close together and passed between the jaws of the pen. Such a cleaner is inexpensive and will not injure the most delicate pen.

Making Small Laps

Where tubing is available, it makes very good laps, but few shops carry a supply of tubing in all sizes, and some may not have it at all. Good laps for drill-jig bushings and similar work, however, can be made of cold-rolled steel or drill rod, which comes in all sizes, and can usually be found in any shop. The rod is sawed lengthwise down the center, and adjusted by spreading the ends apart.

Safe Ladder for the Silo

Most silos have an inside ladder but not many have one on the outside, although the necessity for one here is sometimes just as great. In case the silo is made of hollow concrete blocks, a neat and durable ladder can be built integral with it on the inside, outside or both. The rungs are made from a number of lengths of 5/8-in. iron rod, bent to the shape shown. These are inserted between the blocks, which are grooved to receive the rungs snugly. The ends of the rungs are bent over into the hollows of adjacent blocks to prevent them from being pulled out, and the rungs themselves should extend out far enough to offer a sure foothold even when overshoes are worn. A sufficient number of courses of blocks at the bottom might be



Steel Rungs in Silo Wall Make Strong and Durable Ladder

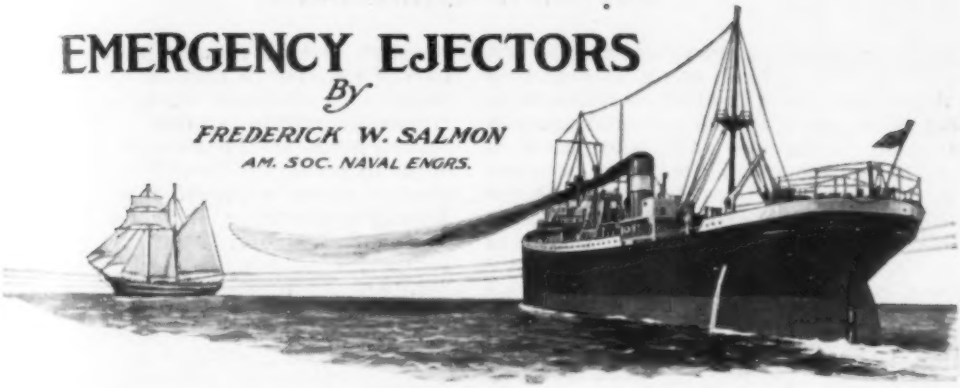
laid without rungs, to prevent youthful investigators from climbing the ladder.

EMERGENCY EJECTORS

By

FREDERICK W. SALMON

AM. SOC. NAVAL ENGRS.



THE ejector is often a very useful device on and about ships, as it is about the only one that the ship's crew can make in a short space of time that will move a large quantity of water. Every seagoing engineer should therefore know as much about it as possible, particularly how best to construct one out of pipe and fittings and use it to get the best results. The writer has found such ejectors of great value on many occasions, and gives here the results of his experience in condensed form.

It is perhaps best to commence with a short description of the theory of the ideal ejector, and so in Fig. 1 is shown a simple elementary type. The water enters the ejector at A, and passes to the steam jet in a spiral so that the streamlines will be easy and the angular deflection small, thus keeping the hydraulic loss low. The incoming water is accelerated in the narrowing passage until it attains its maximum velocity in the throat B. The particles of the condensed steam enter the water at this point and impart to it a large portion of their energy, after which the water moves at a decreasing velocity until it reaches the normal pipe section at C; at the same time the pressure is increased. The things to strive for in the design are: To have the water enter with the least shock or eddy loss and with the least surface or skin loss; to provide just sufficient condensing surface on the steam nozzle; to avoid all sudden changes of form in the throat; to get the water column back to normal velocity at C in the least practical distance, and to prevent radiation losses as far as possible. Fig. 2 shows a home-made ejector of a type often seen; sometimes it will operate and sometimes not, depending on the conditions under which it is tried. Its principal faults are: The steam jet is not of nozzle shape; the water is not properly guided and meets a sudden obstruction at B; there is no throat at A nor recovery cone at C, and no relief for starting at D. In the ejector shown in Fig. 3 some effort has been made to provide a throat at A by using a nipple of smaller size than the ejector body, fitting the nipple by means of the bushings B and C, but this usually results in the steam nozzle being much too long, causing both steam and water losses. This type is open to about all the criticisms directed against that shown in Fig. 2, but it will generally drive out a little water against a higher head than Fig. 2, and so it is often used as a makeshift. Fig. 4 shows an ejector that can be made of practically the same material as that in Fig. 2, but which, experience has shown, is about as efficient a device as can be made with pipe and fittings. The steam nozzle is hammered or swaged a little toward the proper nozzle shape, smoothed out on the inside with an improvised reamer, and turned, ground or filed on the outside (to lessen the draft or wake in the passing water) to a thin edge, say 1/32 in. for the smaller to 1/16 in. for the larger nozzles.

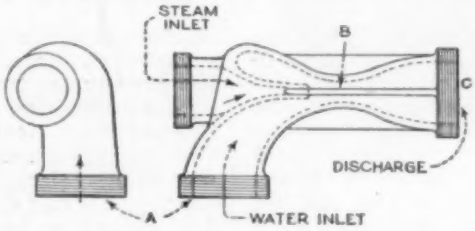


Fig. 1

Drawing Illustrating the Principle of the Ejector

The water passages can easily be made to the shapes indicated at A and B with zinc, white metal, solder, babbitt, or even lead. To make A, screw the steam nozzle tightly into the galvanized-iron plug C, and mold A to the shape desired with

plaster of Paris, sand or even clay. As soon as this is hard, use it as a pattern and make a mold in sand, or whatever is available, with a regular cope and a runner or gate. Open the mold, take out A, C and D and remove all the plaster or whatever was used to form A; then clean the surfaces of C and D well. Fill the inside of the nozzle with sand, rammed hard, to prevent any of the metal from running into it, see that the mold and cope are in good order, put in C and D; then put on the cope and pour. Twenty minutes' work will make a good cast. To make the throat piece, drill a few holes in a galvanized nipple E to hold the fitting securely, and turn or carve a piece of soft wood to form a core for the throat. The cylindrical ends should fit the nipple easily, and the core should be cut in two and the two halves doweled together with a nail, as shown, to permit withdrawal. Place the core in position in the nipple, first coating it with paraffin or grease, and, through the holes in the nipple, fill the space between core and nipple with plaster of Paris. When this has set, withdraw the core, and the nipple can now be used to make a sand core for the actual casting. This is done by cutting some small disks of paper to fit the smallest part of the throat, slipping a wire nail through the center of the disks before they are placed in position, to act as a dowel for the sand core. The sand is now rammed in from both ends until the nipple is well filled, then withdrawn and dried thoroughly. Remove the plaster from the nipple, clean the inside surface well, replace the dried core and bed the whole nipple in sand, with one of the holes up. Pour through this hole the babbitt, or whatever else is used, and, when cold, remove from the sand and clean out the core. All this can also be done in from twenty minutes to half an hour. These times only include working time, of course; in addition to this it may require several hours to dry the sand properly in order to prevent it from "blowing" when the hot metal is poured into the molds. Zinc is much more likely to blow than white metal or lead. Four tablespoonfuls of molasses or sirup, mixed in a cup of water, and added to 2 qt. of fine, dry beach sand will generally make a good core, or a good molding sand, for this work. If either of these ingredients is not at hand, one teaspoonful of wheat flour mixed in ½ pt. of water and gradually heated until boiling will answer the same purpose; a short piece of broomstick or the butt end of a marlinspike makes a good rammer. This ejector will deliver from 40 to 80 times the square of the water-pipe diameter in cubic feet per hour, or from 300 to 600 times the square of the pipe diameter in U. S. gallons per hour. Commonly the suction and discharge pipes are of the same size. In the smaller sizes, the diameter of the steam pipe is half that of the water pipe; a 2-in. steam pipe, however, is large enough for a 5-in. ejector. The ejector should not be expected to deliver against a great head—probably not over 25 ft.—but, by piping the discharge like a siphon, a 15-ft. static head can be cared for over a ship's rail of from 40 to 50 ft. above the water level.

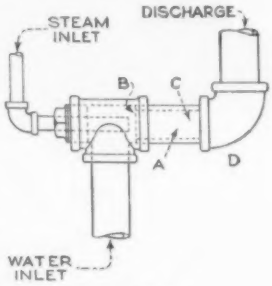


Fig. 2

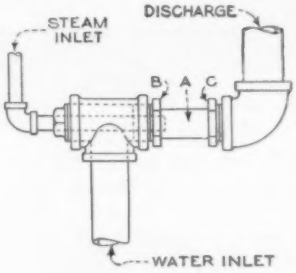


Fig. 3

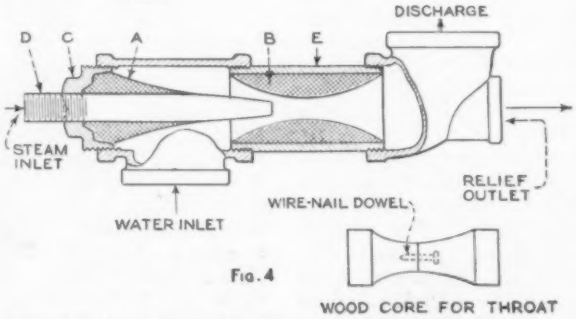


Fig. 4

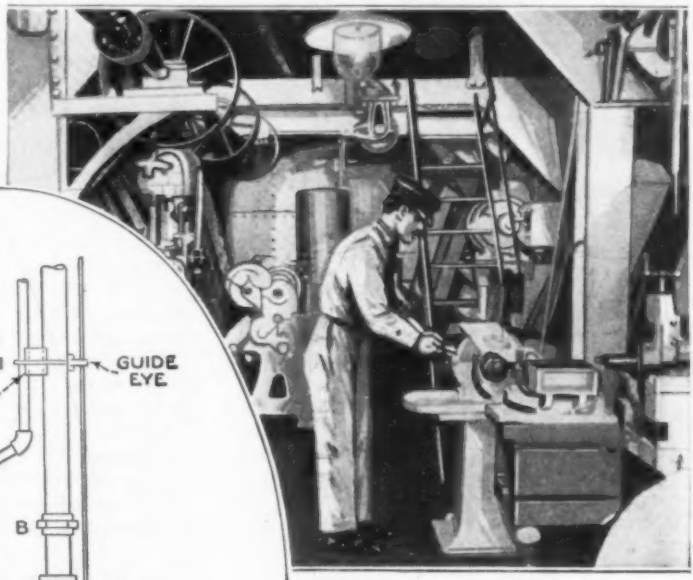
Figs. 2 and 3, Types of Ejectors Frequently Met, but Inefficient in Use; Fig. 4, Construction of Ejector Made of Pipe and Fittings

There is not much reliable data as to the steam consumption of such ejectors, but from experiment, it appears reasonable to expect that they will use about 1/10 to 1/12 of the weight of water they lift, when not immersed in water themselves. The discharge water will generally account for about 98 per cent of the heat in

the steam, but the useful work done, in pounds of water lifted a given number of feet in height, is rather low per pound of steam used. To get the best service, the ejector must not be submerged, but should be set as near the surface of the water as possible. It is often of advantage in starting the action of the ejector to have a relief cock provided, as shown in Fig. 5. This is operated by a rod so arranged that the weight of the rod tends to shut the cock, which should be of the same size as the steam pipe.

In Fig. 5 a good piping arrangement is shown for use when the whole unit has to be lowered into a compartment or hold. Unions are used at B and C to facilitate assembling and repairing. Four suction branches are best to use; two are shown at D and E, and the other two are screwed into the cross below these, and are placed at right angles to them. It is desirable to use a standpipe G, to prevent the end of the suction pipe from being lowered into mud and stopped up quickly. There should be a total of about two hundred ⅜-in. holes in the five pipes; this will give a ratio of hole to pipe area of about 3 to 1; more than this would be better, and each hole should be countersunk with the point of a ⅝ or ¾-in. drill.

The steam and discharge pipes should be clamped together about every 6 ft. A simple and good way of doing this is shown in the upper detail. For temporary service, a wood block has been found satisfactory as a separator, if made amply large, cut to fit the pipes roughly, and provided with a piece of asbestos under the steam pipe. As an example of the practical application of the principles described, let us assume that we wish to remove water as rapidly as possible from a hold, keeping the water down against a leak that is estimated at about 400 cu. ft. per hour as the maximum. We have on hand some 3-in. pipe and fittings; what can we do? Under favorable circumstances we may expect an ejector made of this pipe to deliver from 360 to 720 cu. ft. per hour, according to the rule previously given, so we proceed to make up the ejector, using a 1½-in. steam pipe and the same size of relief cock. This ejector will then gain rapidly on the water.



Method of Installing the Ejector Shown in Fig. 4 to Insure Best Results

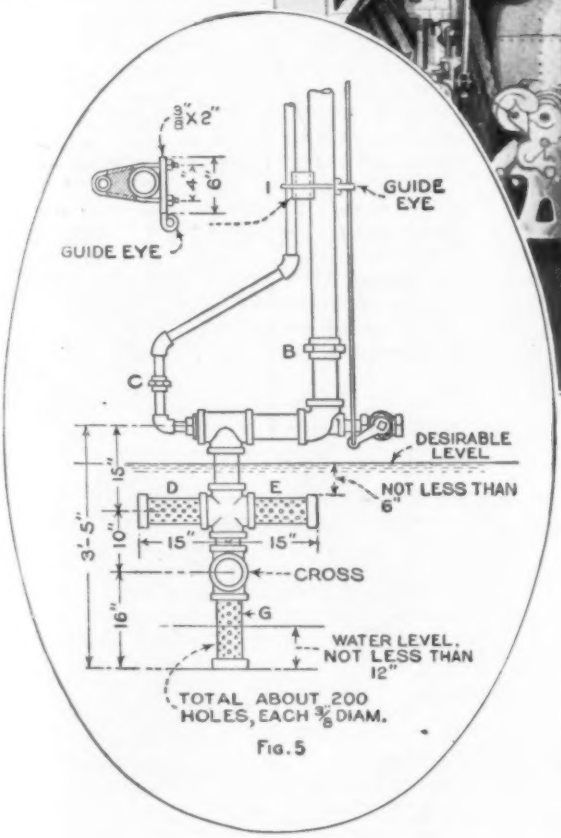


Fig. 5

Tilting Shaker for Sand Screen

Screening of sand for use in concrete on small jobs is usually accomplished with a small screen held and shaken by hand.

A Fixed Sieve That Hastens the Riddling of Sand on Concrete Work

This process is slow and laborious, and a more expeditious and less tiresome method is to use a fixture of the kind shown in the illustration.

Either a round or square screen is adapted for the fixture, which is made simply by attaching two long handles to one end, and two "legs," which are pivoted to two pieces of 2 by 4-in. stock driven into the ground. Two bolts form the pivots, and make the sieve readily detachable when necessary. The sieve is operated by tilting, which slides the sand from one end to the other while dropping it into a barrow placed underneath.

Prolonging Life of Wooden Well Curbs

Wooden well curbs are used quite extensively in rural districts. If they are air-tight or nearly so, moisture arises during cold weather and causes the curb to mold and rot. One should, therefore, allow the moisture to escape. This can be done by cutting away part of the curb and placing a screen over the opening, or if the curb has a lid, by closing this only loosely. It has been found that with either of these precautions a curb will last longer.—Bunyan Kennedy, McCool, Miss.

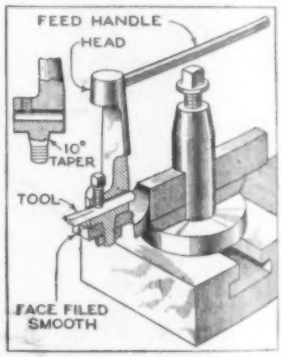
Keeping Grease from Auto Brake Bands

Having grease flow out of the differential on the brake bands is objectionable in that it is difficult to clean off, catches all the dirt and dust and may prevent the brakes from functioning properly. This trouble can be remedied by means of spring washers that fit snugly on the axle shaft.

These are caught in the vise, one at a time, and the ends spread so as to form a steep spiral. They are then forced on the axle so that one end of each washer will interlock with the end of the next and form a complete screw extending from the wheel bearing on each side to the differential. It is necessary, of course, to place the washers on the axle in such a manner that the excess grease will be screwed back to the differential housing, and not away from it.—G. G. McVicker, North Bend, Nebr.

Radius-Turning Tool

Most of the tools or attachments for the forming of radii on the lathe are either too cumbersome or too large to handle small diameters, but the tool illustrated is about as small and neat as it is possible to make. The main body is made from soft steel, of the same size as the usual lathe-tool shank, the front end being forged flat to form the base of the swivel head. The latter combines the pivot, tool-holder, extension-handle holder, setscrews for tightening the tool and pivot stud; the whole thing being worked out of cold-rolled stock. The pivot stud is turned concentric with the tool head while the extension-handle holder is turned eccentric to the whole. A piece of ½-in. rod about 14 in. long is screwed into the upper end of the head and serves as a handle for turning the device in an arc. The face of the body is filed off flat and true and the distance this face projects beyond the true center should be marked with stamps. This distance is then subtracted from the radius to be cut and the result will be the distance



the tool must extend beyond the face of the holder. The pivot should be taper-turned and rest in a taper seat as well as on the flat; a nut will hold the two together at the right tension for easy turning and without chattering.

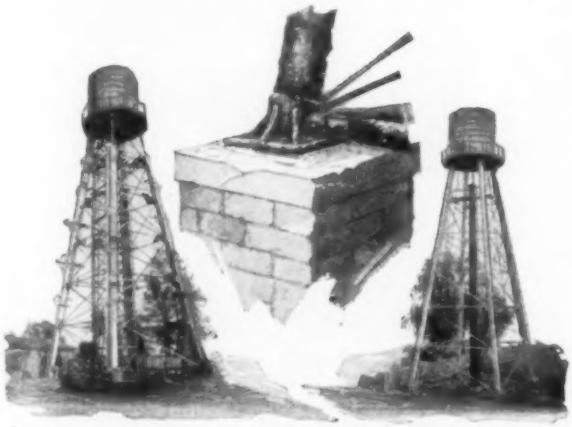
As will be seen by a reference to the drawing, the top of the tool should pass through the same line as the regulation lathe tool. A tool of this type is a great labor and timesaver as, when removed from the toolpost, the accuracy of the setup remains undisturbed.

Reinforcing Corroded Steel Tower

A 75-ft. steel tower supporting a 20,000-gal. tank at the oil mill of the Lookout Oil and Refining Co. at Corinth, Miss., became so weak from corrosion that a collapse was imminent. The general manager, Mr. M. Reynolds, suggested a plan of repairing the tower that proved perfectly successful, and saved the cost of a new tower.

The four main columns consisted of 7-in. wrought-iron pipe, with cross members of 3½-in. pipe, spaced 12 ft. apart. Wood forms, 15 in. square inside, were built around each column, with projecting forms 12 in. square extending out on the cross members for 18 inches. The forms were finished and the concrete poured in 12-ft. sections, care being taken that the reinforcing iron lapped the points where pouring ceased on each section.

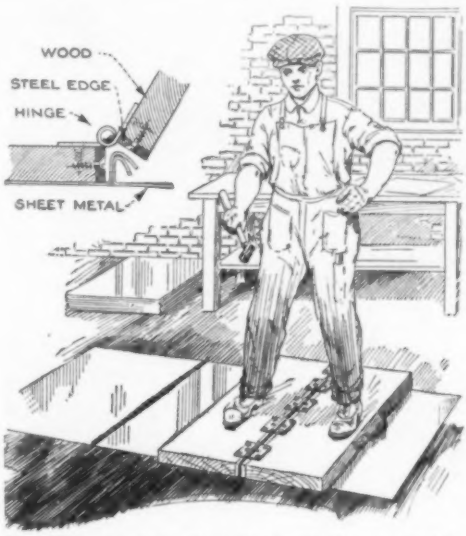
After the concrete had been poured, 10 days were allowed for it to cure, and, when the forms were removed, the columns were found to be perfect, with no evidence of honeycombing. The completed job was found perfectly satisfactory.—H. C. Harrington, Gen. Supt., Chattanooga, Tenn.



Left, the Forms in Position; Center, a Portion of the Corroded Tower; Right, the Completed Job

Seam Folder for Tin Work

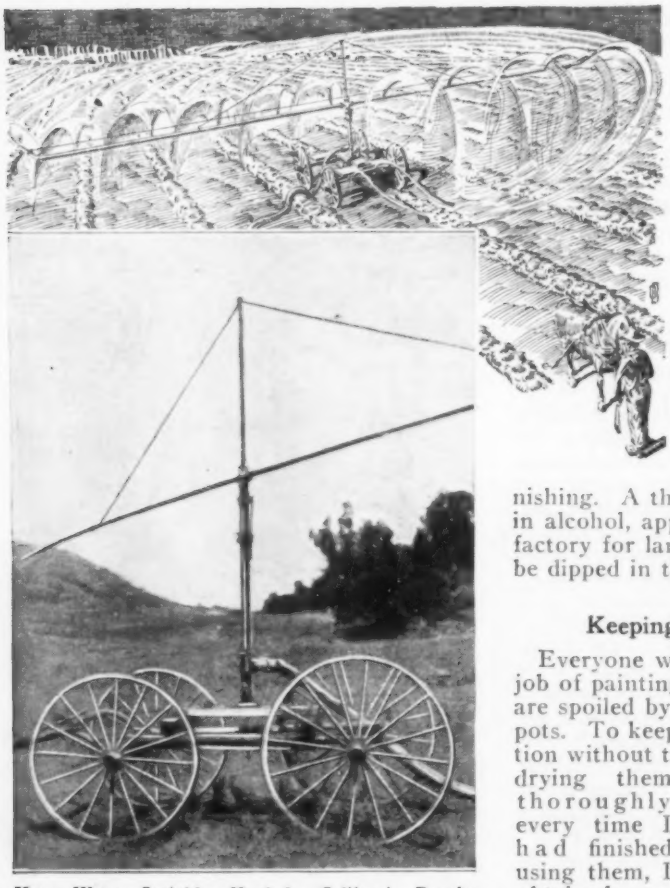
One of the occasional tasks of the sheet-metal worker is to seam together sheets of tin for roofing. Of course, shop equipment can be purchased with which to do



Simple Device Aids Sheet-Metal Workers in Making Seams in Tin Roofing

this work, but the small tinsmith, whose infrequent use for such a device does not justify the expense of purchasing one, will find the rig shown in the drawing just as good for his needs, and its cost is negligible. Two pieces of 1-in. wood of equal size, say, about 10 in. wide and 3 ft. long, are fitted with strips of flat iron on one edge and hinged together with several hinges, fastened to the top. In use, the boards are placed so that the iron edges are over the open seam, as indicated in the detail. Then the boards are pressed down by standing on them, and the seam is ready for soldering. A leather handle is attached to one of the boards, so that the "press" can be moved from seam to seam easily. —G. A. Luers, Washington, D. C.

¶When a barrel of gasoline is allowed to remain in one position for a long time, it frequently happens that the last few quarts of gasoline contain sufficient water to cause trouble in the engine or stove. The water can be removed by dropping a large cotton cloth into the gas and wringing it out. The cloth absorbs the water.



Huge Water Sprinkler Used by California Rancher to Irrigate Land

Huge Homemade Field Sprinkler

A California rancher has improvised a large field sprinkler similar in design to those commonly used on city lawns. It is built upon an old buggy chassis and is made of pipe and fittings picked up on the ranch. The sprinkler arms are 20-ft. lengths of 1-in. iron pipe, giving a spread of 40 ft. and, ordinarily, a reach of 60 ft. The ends of the arms are bent in opposite directions and five small slits are cut with a hacksaw, at regular intervals, into the side of each arm. These slits are, of course, cut on that side of the arm toward which its end is bent, so that the force of the outflowing water causes the pipe to turn. The central support for the arms is made of 2-in. pipe and fittings, and the arms are braced by guy wires from the top of a smaller pipe, as shown. A length of old fire hose is used to connect the sprinkler to the supply pipe from a power-driven pump. Sometimes the wind causes the water to carry over a radius of 100 ft. The sprinkler is moved by hand or horse four or five times a day, and has proved a real money saver.—Geo. E. Bowers, Escondido, Calif.

Brush Finish for Brass

Brass and similar metals may be given a brush finish by rubbing them with steel wool. Care should be taken that the rubbing is done in one direction, otherwise a scratched surface will result. A lacquer should be applied to prevent tarnishing. A thin solution of white shellac in alcohol, applied with a brush, is satisfactory for large work. Small pieces can be dipped in the solution.

Keeping Paint Brushes Soft

Everyone who has to do an occasional job of painting knows how easily brushes are spoiled by letting them stand in paint pots. To keep my brushes in good condition without the necessity of cleaning and drying them thoroughly every time I had finished using them, I obtained an empty 5-lb. tin can, originally used for carbonate of soda; this can was about 5½ in. in diameter and 10 in. deep. One inch below the top I punched eight holes in the side and inserted L-shaped lengths of wire, about 2 in. long. These I soldered to the outside, with one end projecting inside of the can to form a hook. Through the handle of each brush I drilled a small hole exactly 5 in. above the bottom end of the bristles so that these would not touch the bottom of the can. After the brushes were hung up in the can enough turpentine was poured in to submerge the bristles and the cover was then put on to prevent evaporation. In this way the brushes were kept in good condition and ready for use at any time.—C. E. Weibezahl, Syracuse, N. Y.

Making Durable Valve Washers

During a number of years as a railroader and general repairman I have seen much trouble that was due to faulty washers in valves, and in seeking a remedy, I have found that washers made of lead and new babbitt are both durable and leak-proof. In valves for hot or cold water I use lead alone; for steam valves, a mixture of half lead and half new babbitt. Although lead alone will hold steam, I prefer the half-and-half mixture, as it is more durable. New babbitt is used because old bearings and the like are apt to contain bits of iron and steel.

From a small ladle I pour the molten metal into the washer cup of the valve; then, when the metal is cool, I level up the surface with a file. If the valve leaks when tested, I take it out and file the washer on the side where the marks show that it bears heaviest. In this way one can form a valve washer that will last for months, or even years. If there is no screw to hold the washer, the rim of the cup can be dented slightly at the sides to hold it in place.—Clarence Uplinger, Cincinnati, Ohio.

Hinged Track Section in Barn

In a large western dairy barn, with several grain bins at one end and a double conveyor track running from these bins along two rows of mangers, the track crossed over a driveway without leaving sufficient headroom for a loaded rack to pass under it. The trouble was readily overcome by cutting off the sections of track over the driveway and mounting them on lengths of 4 by 4-in. timbers. These were hinged at one end so that they could be swung entirely out of the way to allow the load to pass. When swung back

Sections of Conveyor Track Cut and Hinged on End to Permit Passage of Loaded Rack

again, the timbers are held in line by heavy cleats.—Dale R. Van Horn, Walton, Nebr.

Getting Rid of Chinch Bugs

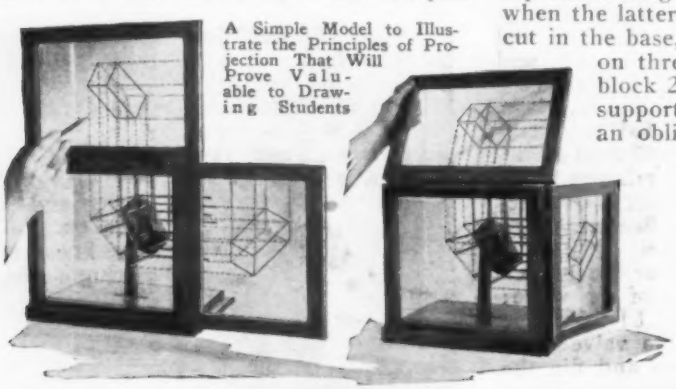
Chinch bugs proved to be one of the most costly pests of the corn belt last season. Damage amounting to millions

Dripping Creosote in Furrow to Protect Field from Chinch Bugs; Cyanide Hole in Foreground

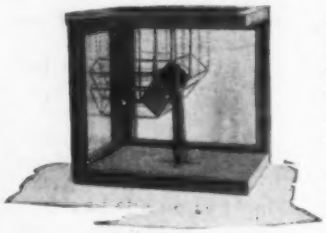
of dollars was caused in the migration from wheat fields into corn, sorghum and other "row" crops. The bugs "march afoot" and methods of controlling them have been based on the establishment of barriers to stop them from reaching their objective. At the Kansas state agricultural college various systems were tested last summer, and a combination of creosote and calcium cyanide was found most effective. The creosote was dripped into a furrow along the side of the field to be protected, and every few feet along the furrow holes were dug in which flakes of calcium cyanide were deposited. Unable to cross the creosote line, the bugs crawled along it until they reached a cyanide deposit and were killed by the deadly and low-lying gas given off by that substance. Barriers of calcium cyanide, without creosote, were found ineffective.

"Working Model" Aids Drawing Students

Drawing instructors often find it difficult to explain to their students how three different views of a model or other subject are projected on paper. The model shown in the illustration makes the task easy and the students are enabled to grasp the principles of projection very quickly.



A Simple Model to Illustrate the Principles of Projection That Will Prove Valuable to Drawing Students

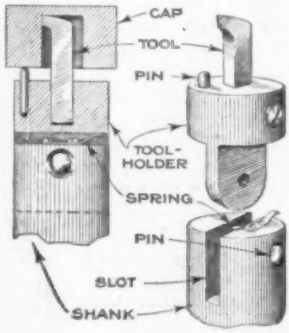


The model consists of a substantial wooden base, about 13 in. long and 10 in. wide, to one side of which is fastened a frame holding a sheet of glass. The frame is about 12 in. high, and to one side and the top two similar frames are hinged, the top one folding down against the side one when the latter is brought against a step cut in the base, thus inclosing the object on three sides. The object is a block 2 in. square and 4 in. long, supported on a wooden pillar at an oblique angle to each of the three frames or planes of projection. The projection lines are represented by small brass rods, three of which are fastened to each corner of the block at right angles to each other, and running to the three glass planes. On each plane is drawn an accurate projection of the block by simply joining the points represented by the ends of the rods behind the glass, and dotted lines running from these points to the edges of each plane show clearly how one view is projected from the other.

The swinging of the frames into one plane puts the drawings in the final position required on a flat sheet. This makes it perfectly simple to explain how the object is "swung" in the mind's eye to obtain three different views on the drawing paper. —Sherwin M. Turrill, Maywood, Ill.

A Simple Recessing Tool

An easy way to make a tool suitable for recessing caps, shouldered nuts, and the like, in the hand screw machine is shown in the drawing. The tool is made in two pieces, the shank and toolholder proper, the former being turned to fit the turret and the front end slotted across. The toolholder is milled across both sides, leaving a flat portion which fits the slot in the shank. The front is bored out to take the recessing tool and drilled at one side for a pin. The toolholder can be held to the shank by a screw or taper pin, as desired, provided that it is allowed freedom to move in the slot. A flat spring, bent upward at each end, and fastened to the shank with two small screws, serves to keep the tool from flopping about. It can be seen that when the pin driven into the face of the toolholder reaches the face of the work it causes the tool to feed inward and thus cut the recess. It is important when setting a tool of this character to note that the tool travels a little in a direction parallel to the bore of the work after the pin touches the face of the piece. Consequently the tool should be set so that it is a trifle away from the back face of the work when the pin touches the front face. When the tool has reached the desired depth of cut it will have traveled in a slight arc and should finish the cut touching the back face.



¶Small articles, such as nuts and screws, that have fallen into some inaccessible place can often be picked up by means of chewing gum stuck on the end of a stick.

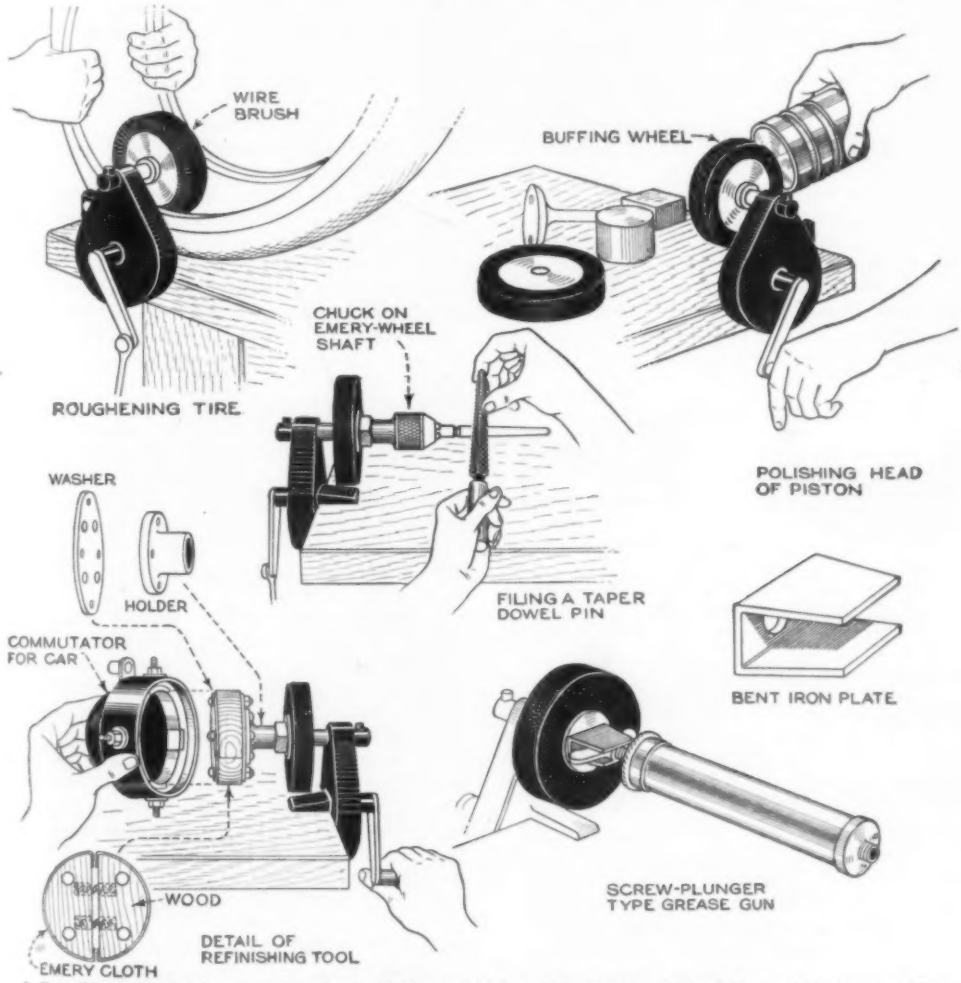
Getting the Most Out of the Grinder

By G. A. LUERS

MANY owners of bench hand-driven emery grinders get little out of them beyond the grinding of chisels, scrapers and an occasional screwdriver or other tool. A few men, on the other hand, with a little ingenuity, accomplish real work with them, and get the utmost in service out of the high-speed little tools. In the small shop or garage, where space is at a premium, and where the purchase of even one additional tool means a hardship at times, the hand grinder may be made into a machine of numerous uses and undoubted value.

The first thing to be done to increase its usefulness is to fit it with some kind of a foot treadle, so as to leave both hands free to handle the work. This may be done in a variety of ways, none of which are shown, as the job is a simple one for any mechanic, and depends, to some extent, on the location of the grinder. With the treadle in place, much work can be done that would be impossible without it.

A common round wire scratch brush, fitted in place of the grinding wheel, permits the tool to be used for such work as roughening tire casings and tubes for patching. Anyone who has attempted to hold a heavy casing open while scratch brushing the inside for a patch will appreciate the saving made in time and temper by the use of the little machine. The scratch brush will also serve for free-



A Few Fixtures That Increase Greatly the Utility and Value of the Neglected Hand Emery Grinder, and That Save Time and Dollars in the Small Shop

ing engine parts of carbon, cleaning pieces to be soldered and removing rust.

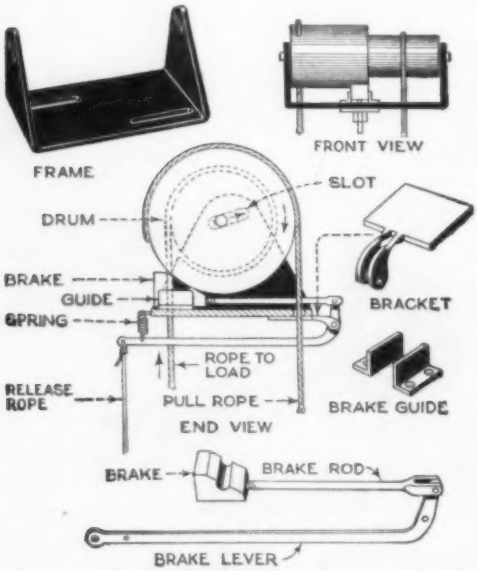
To polish the brass and nickel parts of a car, a buffing wheel is substituted. This wheel also makes it possible to give the tops of pistons and valves that fine polish that is so effective in preventing the rapid accumulation of carbon. In fact, the uses of the buffing wheel are legion around the shop and garage.

If a small drill chuck is used on the spindle of the grinder, a surprising number of jobs can be done with it. Holes that are not required to be accurately located can be drilled, small round parts can be filed to size, needle valves trued, dowels fitted, engine-valve stems polished —in fact, almost any work for which a small polishing lathe is commonly used. On one occasion I saw a car owner true up the commutator segments of his generator by means of the chuck on his grinder and a small improvised end support. If a small split wooden pulley is made and mounted on the spindle of the grinder, as shown at the lower left of the drawing, it becomes an easy matter to true up the inside of Ford commutators. Small springs are placed between the sections of the pulley and the surface is faced with emery cloth. This has been found very useful in a Ford service station. In the same shop is found the device shown at the right. This consists merely of a piece of sheet steel or iron, bent to a U-shape, and drilled at the bottom of the "U" to fit over the spindle of the grinder. It is a tiresome job to unscrew the plunger of a large grease gun by hand for refilling, but by placing the end of the plunger in the U-shaped chuck and running the grinder, the plunger is turned out in a few seconds.

The examples shown are merely a few of the many uses to which the hand grinder can be put in the small shop; any mechanic can think of many more and increase the utility of a little-used tool.

Simple Brake for Hand Hoist

The illustration shows an unusual hand-hoist construction, which has a self-locking brake. The drum on which the hoisting ropes are wound is turned down to two diameters to obtain greater leverage, the rope to the load being wound on the smaller section and the pull rope on the larger. The load rope is attached so that it will be wound up when the drum is rotated toward the right, as indicated by the arrow in the center figure, and the pull rope is attached so that it will unwind while the former is winding, and vice versa. The drum is held in a steel frame of the type shown at the upper left, slots being used for bearings to permit a slight lateral movement of the drum, which engages it with or releases it from the brake arranged below. The bearing slots are inclined so that when the pull rope is unwound the shaft climbs up the slots, releasing the drum from the brake. On the other hand, the shaft runs down the incline of the slots the moment the pull rope is let go and the drum is held securely when it rubs against the brake. The brake, brake-rod and brake-lever assembly is shown in the lower detail. It is attached to the frame under the center of the drum so that the brake works against the larger section. Two pieces of angle iron are fastened to the frame to serve as guides for the brake, and a short coil spring is attached to the frame and brake lever to hold the brake tightly against the drum. A small bracket to hold the brake lever is cut, and bent to the shape shown in the right-hand detail; it is attached to the underside of the frame, and the brake lever is pivoted on it. A rope attached to the end of the brake lever enables one to release the brake.



Unusual Type of Hand-Hoist Mechanism Which Is Equipped with Self-Locking Cable

¶ Burnt umber with white and orange-chrome yellow will give a variety of clear, warm drab colors.

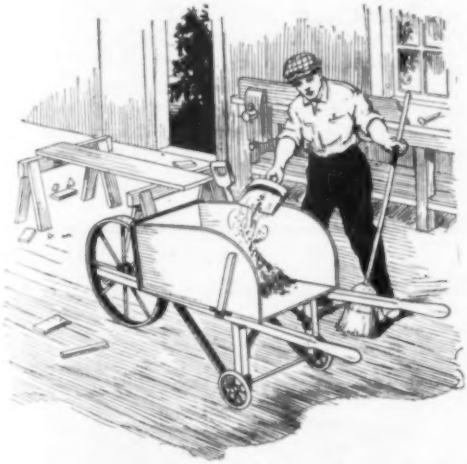
Finding Loose Wristpins

A wristpin may be loose enough to knock and yet, when examined, no perceptible play may be found in it. In such a case the connecting rod should be held in a vise and the piston rocked up and down in the plane of the wristpin. If an oil film comes and goes between the pin and its bushing the pin is too loose, and new pins and bushings must be fitted. The old bushings may be reamed out and oversize pins fitted, if desired.—H. F. Blanchard, Tuckahoe, N. Y.

Auxiliary Wheels for Barrow

For certain purposes, such as sweeping cuttings from the floors of shops, and similar work, a pair of small auxiliary wheels added to the shop wheelbarrow will prove very practical.

This arrangement enables the worker to slide the barrow from machine to machine as desired, with the ease of moving a three or four-wheel truck, yet when the barrow is full, it may be lifted and rolled away in the usual manner to the yard, or through passageways where it would be impossible to handle the ordinary truck. A push moves the barrow several feet, while without the small wheels the handles must be lifted to move it.

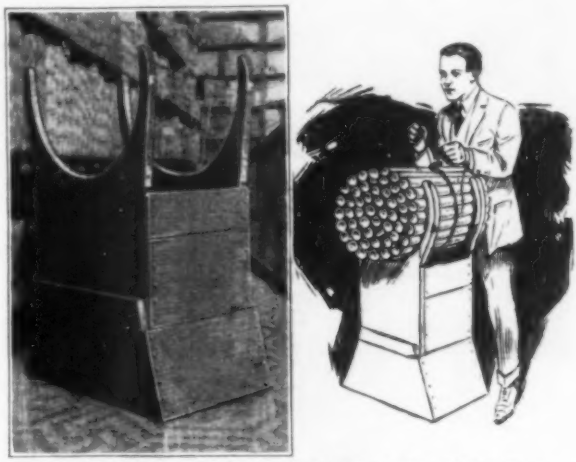


Small Auxiliary Wheels Added to the Barrow Lighten the Labor of Sweeping the Shop

¶ A non-magnetic cast iron is being produced by a concern in England.

Tying Bundles of Wall Paper

In order to tie up bundles of wall paper quickly and conveniently, a dealer provided the novel holder shown in the photo and drawing. It is made of wood and has four arms extending from the top. Rolls of wall paper are placed in the space between these arms, and it is then an easy matter to tie a cord around the rolls and make a bundle. This method was found much better than the usual one of holding the rolls while attempting to tie them up.—Charles A. Goddard, Los Angeles, Calif.



Convenient Holder Facilitates Tying Up Rolls of Wall Paper

Testing Fit of Rod Bearings

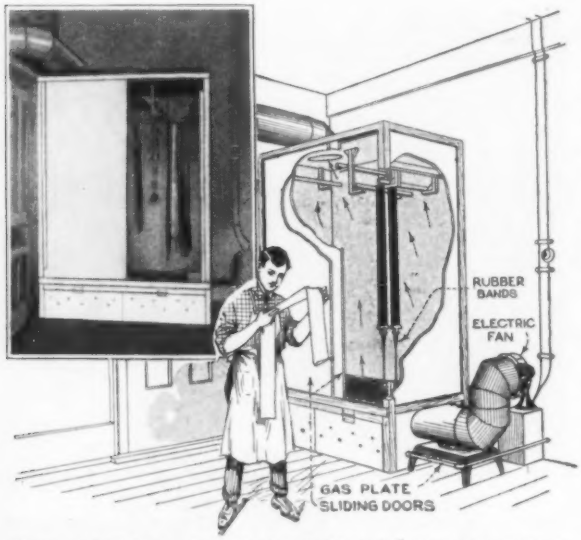
When adjusting a connecting-rod bearing (with the engine in the car), the simplest way to determine when the bearing is just tight enough is as follows: Remove shims or file the cap until the rod is just too tight to be moved lengthwise by hand, but not too tight to be shifted slightly by tapping with the hammer.

Repairing Leaky Spark Plugs

Spark plugs having a removable center wire sometimes leak compression at this point. Often the reason is that the insulator has chipped away where the flange on the wire seats against it. This trouble can usually be remedied by slipping a thin brass washer, of the same kind as that used on top of the plug, over the center wire and drawing it up against the porcelain. As such washers are too large for this use, they must first be trimmed down with tinners' snips.—E. T. Gunderson, Jr., Humboldt, Iowa.

An Efficient Film-Drying Cabinet

The film-drying cabinet shown in the illustration was cheaply constructed, and a similar one can easily be made by anyone handy with tools. It will hold over 100 rolls of film, and will dry them in from 30 minutes to one hour.



Cheap and Efficient Film-Drying Cabinet for Professional Photo Finishers That Hastens the Work

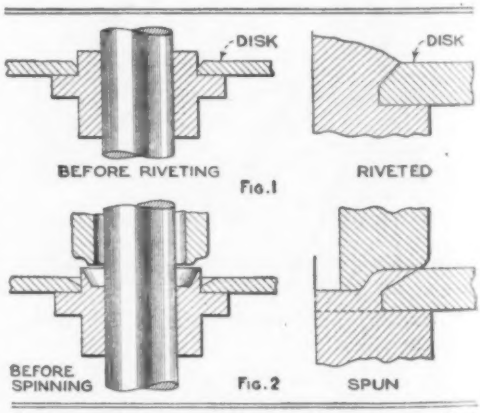
The cabinet is made of wallboard, which can be obtained from any builders' supply house, nailed to a stout wood frame. Racks, made of 1 by 1-in. wood, are fastened to the top to hold the upper end of the films, and about 1 ft. from the floor a number of wood strips are nailed across the cabinet to hold the bottom ends. Holes are cut in the top and bottom of the cabinet, as shown in the drawing, to receive the ends of lengths of stovepipe. The upper pipe is led outdoors, and the bottom one is connected by means of a couple of elbows to an electric fan. A gas plate is set below the bottom pipe, a little away from the cabinet, to heat the air as it passes through. The upper ends of the films may be attached to the cross strips by means of thumbtacks, or the strips may be provided with nails on which to hang regular film clips. A number of film clips, each pair of which is joined with a stout rubber band, are provided to hold the bottom ends of the films. One clip is fastened to the bottom of the roll and the other to one of the lower cross strips. As an alternative, the bottom strips may have nails part way driven into them also, and the ends of the rubber bands be hooked over the heads of the nails. It will be found desirable to provide bands of varying lengths, to take care of different films.

It will be noted in the drawing that the front of the cabinet bottom is hinged to form a door. This is convenient for removing the dust that accumulates in the bottom. The wallboard front of the cabinet is made in two sections arranged to slide in the frame. This construction has been found better than doors opening outward, as it saves considerable space and eliminates the necessity for catches on the doors.—H. C. Graves, Watertown, N. Y.

Riveting Disks to Hubs

When attaching a disk to a hub on small work the common practice is to make the hub long enough to project through the disk, which has been beveled, and then hammer the hub so that the metal spreads and holds the disk more or less tightly as shown in Fig. 1. This method has the disadvantage that the disk has a tendency to run out of true due to uneven riveting.

A better method is shown in Fig. 2. The hub is made with a cup edge and the disk is given a wide bevel. A tubular tool is turned up to the shape shown, hardened, polished, and revolved in a drill press so that when it is brought down on the hub it curls the metal out and forces it down into the bevel, and finally burnishes it neatly.



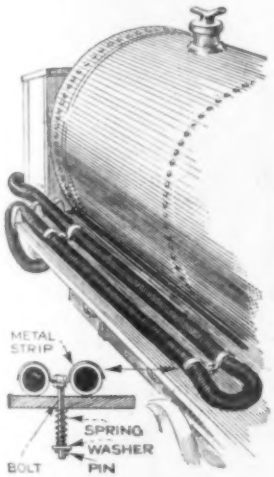
Common and Improved Method of Attaching a Disk to a Hub

Celluloid Keeps Report Sheets Clean

Anyone working in a shop where it is impossible to keep the hands clean, knows how difficult it is to keep report and record books clean if the workmen have to make entries in them. However, the difficulty is easily overcome by keeping a few sheets of thin celluloid handy on the shop desk (old photo negatives about post-card size, with the emulsion cleaned off, will do nicely). When a workman has to do some writing he lays one of these on the paper where his hand rests, and as he writes, the piece of celluloid will slide over the paper with the hand.

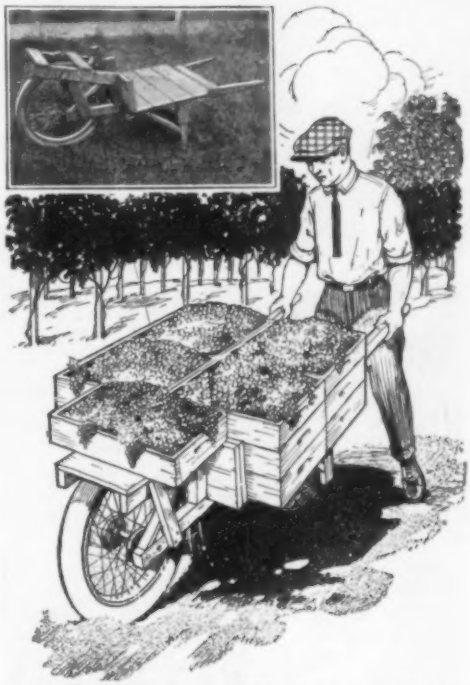
Spring Clip for Tank-Wagon Gasoline Hose

When required to make some kind of holder to keep the gasoline hose from coming off a tank wagon or damaging the paint, the writer devised the clip shown in the drawing, which has been in operation for some time and has proved very satisfactory. It is simple to make, instantaneous in action, and is much better than straps. The clip itself is made of the heavy galvanized strap which comes around bundles of sheet metal; this material is good mild steel. A ½-in. bolt 7 or 8 in. long, with two nuts, and a light coil spring with a washer and cotter pin are the materials required for each clip, in addition to the steel. The method of mounting the clip is clearly shown in the drawing.—B. E. Dobree, Victoria, B. C., Can.



Motorcycle Wheel Improves Wheelbarrow

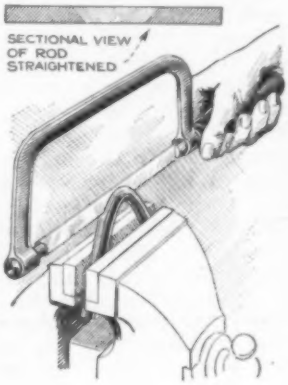
An ordinary wheelbarrow is difficult to handle in soft dirt or sand because the wheel sinks down into the soil, sometimes so deeply that it is almost impossible to push it, especially under a heavy load. An Oregon farmer, who experienced this trouble in transporting grapes from his vineyard, fitted a wheelbarrow with a motorcycle wheel. The tire is partly inflated and will not sink deeply into the sand, even when the barrow is loaded to its full capacity.—Ed. Fraser, Ashland, Oregon.



Pushing Heavily Loaded Wheelbarrow over Loose Sand Is Facilitated by Use of Motorcycle Wheel

Cutting Slots in Small Rods

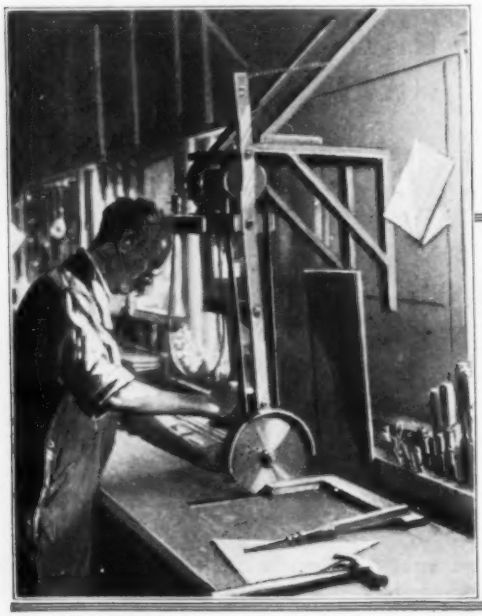
Cutting slots in small rods is usually quite a difficult task. However, a simple method of doing it is shown in the illustration. The rod is first bent sharply at the point where the slot is to be cut and is then inserted in a vise, as indicated, so that a hacksaw can be used to cut the slot. After the slot has been cut the rod is straightened.



Homemade Swing Cut-Off Saw

By D. R. VAN HORN

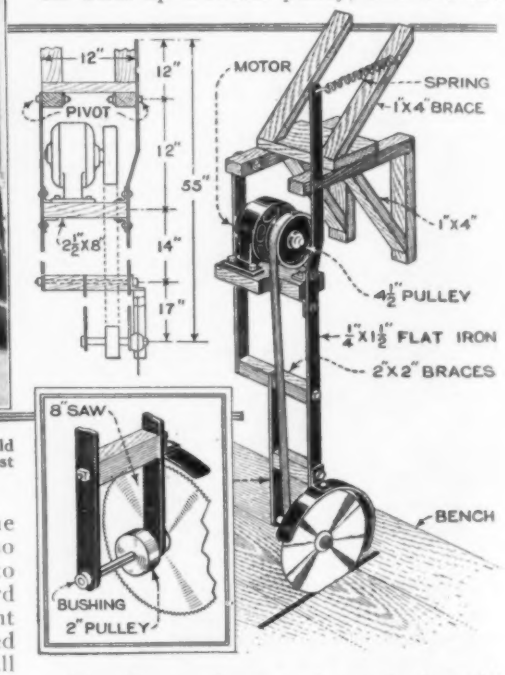
THE swing cut-off saw is a very handy addition to the woodworking shop, and the making of one is no very hard or expensive undertaking, as the saw in the illustration shows. This saw was made from scrap, with the exception of the saw and its bearings, and the motor, which was



A Swing Cut-Off Saw That Is Very Simple to Build and That Will Give Just as Good Service as the Most Elaborate Commercial Saw

purchased from a secondhand dealer. The whole saw is self-contained and is so nicely balanced that a touch is sufficient to move it against the work. The saw guard makes it safe to operate, and a convenient switch permits it to be started and stopped instantly. The construction of the wall hanger is simple. Two triangular brackets, of 1 by 4-in. stock, are firmly fastened to the wall at the proper height and braced as shown in the drawing. If desired, the hanger may consist of a piece of 2 by 8-in stock, with the braces and back members of 1 by 4-in. stuff, thus making the top of the brackets solid instead of open. To the sides of the hanger two flat side irons, one 26 in. and the other 55 in. long, are bolted, the holes for the bolts being drilled so that the irons will swing freely but without sideplay. Part of the longer iron extends above the hanger and is drilled at the top to take a strong spring, the other end of which is fastened to one of the top braces. Between the irons the motor support, of 2½ by 8-in. stock, is fastened by means of angle irons bolted to the support and side irons. At the end of the 26-in. piece a 2 by 2-in. brace is bolted, the bolt running through the end of a 19-in. piece of flat iron, which completes the lower end of the frame.

This end carries the saw, which runs in bronze bushings salvaged from an old automobile. A 2 by 2-in. brace is bolted across the lower frame irons above the saw, and the saw spindle is fitted with a 2-in. pulley. The motor is fitted with a 4½-in. built-up wooden pulley, and the saw



with a heavy sheet-steel guard, riveted to a small angle, which is held by the bolt that fastens the lower 2 by 2-in. brace. The 8-in. saw will handle up to 2-in. stuff and is run at 3,000 r.p.m

It may be seen from this that the construction is exceedingly simple and inexpensive. The costliest part of the outfit is the ½-hp. motor, and even this may be picked up secondhand for very little money.

¶A good rule to follow when grinding milling cutters is to allow 7° clearance for roughing and 5° for finishing cutters.

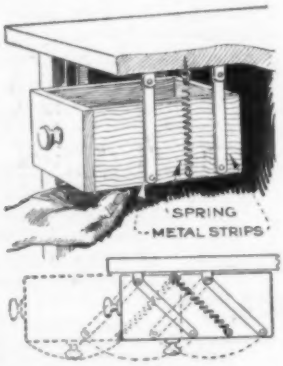
Breaking Up Old Concrete Pavement

When breaking up an old concrete pavement on the main street in Scottville, Mich., dynamite could not, of course, be used, owing to the proximity of the store windows on both sides of the street, so the method shown in the photo was tried and found successful. A strong chain with a hook was hitched to a powerful caterpillar tractor, the hook being placed under the edge of the pavement and a block of wood put under the chain to make the hook pull upward when the tractor moved forward. Each "bite" of concrete was several square yards in area.—M. M. VanValkenburgh, Cadillac, Mich.

Breaking Up Old Concrete Pavement with Aid of Powerful Tractor and Hook

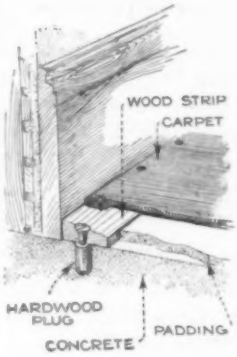
Drawer Foils Petty Thieves

Garage men and other mechanics, who are employed in shops where the public is free to enter, are often inconvenienced by the loss of small tools and personal articles. To keep these in a locked drawer is too inconvenient and therefore the arrangement shown in the illustration was devised by one mechanic. An ordinary drawer is provided with a knob on the front in the usual way and another knob on the underside, the former being merely a "dummy," while the latter is actually used to open the drawer. Two lengths of 1 by ⅛-in. flat iron are hinged to the underside of the bench top on either side of the drawer, the lower ends being fastened to the drawer with flat-head screws. A stout coil spring is also attached to the drawer and the underside of the bench top as shown; it should have enough tension to keep the drawer and its contents in the position indicated in the lower detail so that a straight pull on the front knob will not open the drawer. It can, however, easily be opened by pulling downward and forward on the hidden knob underneath. A keyhole in the front of the drawer will add to the deception and lead the petty thief to believe that the drawer is locked.



Attaching Carpet to Concrete Floor

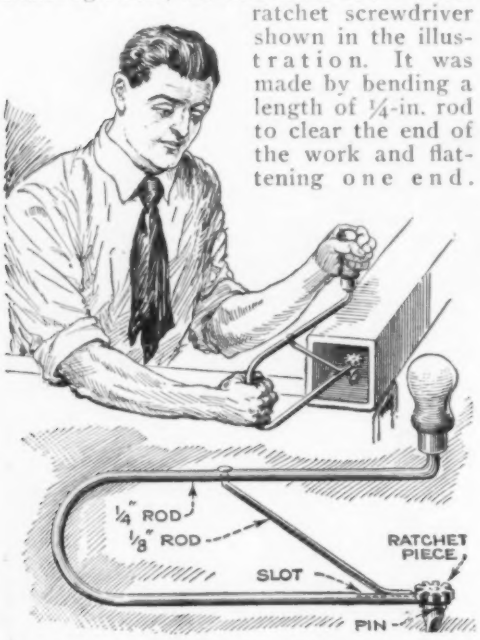
Attaching a carpet to a concrete floor is rather difficult because nails or tacks cannot be driven into the concrete. It can easily be done in the following way, which, however, requires the use of padding under the carpet: Drill holes in the concrete along the edge of the wall about 1 ft. apart, and plug these with hardwood. A tapered wooden strip of approximately the same thickness as the padding is run along the edge of the room, being screwed to the wooden plugs. The padding is then laid on the floor, and the carpet stretched over it and tacked to the strip.



¶When no resin is at hand, a glazed and slipping belt can be made to grip by throwing a handful of ashes on it.

A Novel Ratchet Screwdriver

In tightening screws set in the ends of square-section pieces not furnished with a through hole, use was made of the novel ratchet screwdriver shown in the illustration. It was made by bending a length of ¼-in. rod to clear the end of the work and flattening one end.



Novel Ratchet Screwdriver Used to Drive Screws Hard to Reach with the Ordinary Type

The flattened part was drilled to take a ratchet piece, slotted in the usual manner and held in place by means of a pin. A groove is cut in the top of the rod and a piece of ⅛-in. wire, attached to the top of the rod, slides in this. The ratchet action is simple; the operator presses on the handle to cause the wire to engage with one of the grooves of the ratchet. The screw is driven in by moving the rod with the other hand. To turn the rod back, the pressure on the handle is released and the wire slides out of the ratchet slot.

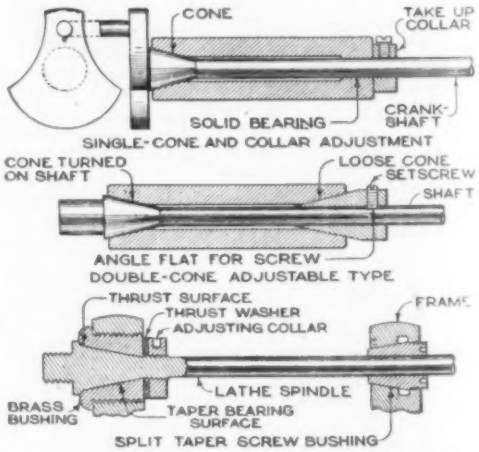
Making and Using Small Cone Bearings

Cone bearings are ideal for small model work for the reason that they are adjustable for wear, and for smooth-running models, a nice snug bearing, without shake, is desired. Cone bearings are also used in preference to straight bearings, as it is almost impossible to make a small bearing accurate in alinement and so that it will not wear large in a short time. The split bearing is also less desirable in model work as it makes for difficult construction.

The first type of cone bearing shown in the drawing, and the simplest, is one with a cone turned on the end having the hardest wear, such as the crank end of a small crankshaft. This bearing has a take-up collar setscrewed to the shaft, which is used to hold the latter in a proper adjustment. A solid rear bearing is used for this type. The space between the two bearings forms an ideal oil chamber which adds to their life.

The second style is of the double-cone type and has a cone turned on the shaft at one end and carries a loose or sliding cone on the opposite end. The sliding cone is setscrewed to the shaft, the screw resting on the slanting flat which prevents the cone from shifting backward when adjusted in place. This is a very good design of bearing, as wear can always be taken up on both bearings alike. Such a bearing is suitable for high-speed and precision work on such machines as small internal grinders and the like.

The third type is known as the cone-type lathe spindle. A cone having two tapers is turned on the chuck end of the spindle. The shallow taper is 15° and the steep taper or thrust angle is turned at an angle of 45°. As most thrusts are endwise on a lathe spindle, a light fiber washer and adjusting collar are provided to keep the bearing tight. The bushing of the other bearing is a taper fit in the frame of the machine and, being split, is adjustable for tightness by advancing it forward into the taper hole. This type of bearing is only found in the most accurate and expensive lathes and is used to best advantage on small precision machinery.



Three Types of Cone Bearings for Model Machinery of Different Types

Prize Offers and Announcements

$50—Snare for Live Fowls

In transferring live chickens from one coop to another, occasionally one or more will escape, making it necessary to be run down and caught, requiring at times considerable effort. We are now using a small wire "V"-shaped hook attached to a long wooden handle which is not very practical. We will pay the sum of $50 for a method accepted by us, or a satisfactory designed hook, which will enable a person easily to catch the fowl around the legs or otherwise. Address Security Produce Company, 209 West South Water Street, Chicago, Illinois.

$50—Profitable Uses for Eggshells

In our egg-breaking plant where several cars of eggs are broken each day for canning purposes, there is a large by-product of eggshells. While these have been used heretofore for chicken feed, we will pay the sum of $50 for a satisfactory plan, process or method of otherwise profitably disposing of these eggshells. All entries for both the offers are to be judged by this concern alone, and the date of closing for each is May 1, 1925. Address Security Produce Company, 209 West South Water Street, Chicago, Illinois.

$1,000—Cost Reduction

This concern makes the Kirstin Fil-Gage for filling Ford automobile gasoline tanks under the seat without need of removing the cushions. It has an indicating gauge in plain sight of the driver at all times and is attached to the tank opening in place of the cap. The Fil-Gage is made of black-finished sheet metal. Our factory operates in large production, and for any accepted improvements not yet tried out or developed which will increase the efficiency of this filler and gauge and decrease manufacturing costs, we will pay the sum of $1,000. Or, we will pay this amount for any suggested changes satisfactory to us which will reduce the production cost 20 cents on each article. No theoretical suggestions will be considered. To qualify, entrants must have actually tried their improvements in operation on one of the devices and have proved it practical and workable. The Fil-Gage containing the improvement must be sent to us by registered mail for testing and upon acceptance and the assigning to us of patentable rights, we shall pay the amount stated to the entrant whose ideas we adopt. This offer expires May 1, 1925. Address, A. J. Kirstin, General Manager, A. J. Kirstin Company, Kirstin Bldg., Escanaba, Michigan.

$1,000—Improvements to Lathes

In four awards of $500, $250, $150 and $100.

These awards will be paid for the four best ideas for new and practical attachments for a screw-cutting engine lathe. The mechanical application and the idea must, of course, be heretofore untried and original and may consist of a distinct improvement on an attachment now in use or a direct improvement on any part of a screw-cutting engine lathe. Value and merit of improvements or suggestions will govern the order in which the allotments of the four awards will be made. The offer expires May 1, 1925. Address all suggestions to South Bend Lathe Works, 423 East Madison Street, South Bend, Indiana.

$50—Formula for Writing Ink

If it is possible to improve the quality of their Tar Black ink, the Hunt Pen Company, makers of Speedball lettering pens and inks, will pay the sum of $50.00 for such a formula, provided the ink meets the following requirements to the satisfaction of the company. It must be jet-black and must dry moderately quickly with a slight reddish tinge, as this is desirable for reproduction purposes. It must be waterproof, must flow freely and still be dense enough to cover opaque when thinned out in the larger-sized pens. If the formula can be made to include colored inks, it will be more desirable. Address C. Howard Hunt Pen Company, Camden, New Jersey. This offer expires May 1, 1925.

$500—Bait for Rat Poison

We have perfected and patented a new chemical composition based on cyanide, the smallest particle of which in a rat's stomach will cause the animal's instant death. By the use of this poison rats die within a foot or two of where they eat it. We desire to market this poison already prepared, so that the user has simply to spread the poisoned bait in infested areas. The bait should be a neutral one, that is, neither acid nor alkaline, and of such a nature that it can be manufactured in small particles about the size of a grain of wheat, so the rat will be tempted to eat them where he finds them instead of carrying them away. What is required is a bait, filler, or carrier which will have either an odor or food appeal sufficient to impel rats to eat it, even in the presence of other food. It should be a bait or food which rats will prefer to any other that would ordinarily be available. For a satisfactory formula, or bait combination for the poison that passes our tests, this concern will pay the sum of $500 in cash. This offer is good for one year from November 1, 1924. Address American Chemical Works, 720 Washington Avenue, Minneapolis, Minnesota.

$300—Hand-Printing Press

The sum of $300 in cash and royalties will be paid for a satisfactory design and drawings of a simple self-inking hand-operated printing press by this donor. The press should be six by nine inches in size and one which can be manufactured from cast iron at a cost not exceeding $25.00. All designs submitted must of course meet the requirements of the donor before being considered for adoption. Address all matter to C. L. Whitfield, 429 East Bute Street, Norfolk, Virginia. May 1, 1925, is the closing date for this offer.

OFFERS ANNOUNCED IN PREVIOUS ISSUES

All of These Offers Expire May 1, 1925

ROYALTIES OF $5,000 WILL BE PAID within the first year for method of animated drawings by which yachts and boats can be illustrated to prospective purchasers. Problem NA-1.

$1,000 WILL BE PAID BY THE HAPPINESS Candy Stores, Inc., for a method of manufacturing chocolate coating which will not turn gray or dull when exposed to atmospheric conditions.

$10,000 IN RETURNS FROM SALES IS ALSO offered by the National Company for a highly efficient fixed radio condenser of small size and large capacity.

A PIECE OF NEW MERCHANDISE THAT could be sold through optical, photographic and sporting goods stores is desired by Wollensak Optical Co., who will pay royalties of $5,000 for accepted article.

FOR PROCESS OF MAKING HARD-GLOSSED candies without impairing their appearance or quality the Happiness Candy Stores, Inc., will pay the sum of $1,000.

THE NATIONAL COMPANY, INC., OFFER $10,000 in percentages from sales for a new radio static or interference eliminator.

CONTINENTAL CAR COMPANY OFFERS $5,000 in royalties for hoist for dump bodies operated by motor vehicle from driver's seat with power from engine; $1,000 under like arrangement for new toy or article of household furniture to be made from lumber scraps of truck bodies. Also $5,000 in royalty arrangement for air-dumping device to be controlled from locomotive by engineer.

FOR A NEW METHOD WHEREBY SCRAP leather in a glove factory can be profitably disposed of, Eisendrath Glove Company will pay sum of $5,000.

NATIONAL SLATE ASSOCIATION WILL pay $200 for best suggested new use for slate; other accepted suggestions paid for in proportion to value.

WILLIAM H. MITCHELL COMPANY WILL pay $500 for three new uses suggested for low-voltage generators which they adopt as part of sales plan.

FOR AN ANTI-FREEZING INGREDIENT FOR an emulsified asphaltic concrete S. D. Hofheimer will pay the sum of $500.

GRANITE STATE MOWING MACHINE COMpany offers $500 in cash and royalties for satisfactory working drawings for gasoline-motor lawn mower they accept for manufacture and marketing.

NATIONAL BRASS COMPANY WILL PAY $300 for design of key guide that can be made of sheet metal and which will properly fit escutcheon plate of similar material.

FOR A PRACTICAL INEXPENSIVE MEANS by which carbonization can be prevented in portable oil burners of vaporizing type, Aeroil Burner Company will pay $500.

THE YELLOW CAB MANUFACTURING company offers an award of $50,000 for a perfected plan of traffic and pedestrian correction and regulation, including mechanical devices, regulations, etc., for the promotion of greater street safety.

$10,000 FOR A NEW MUSICAL INSTRUMENT which can be incorporated in any orchestra or brass band and will take a place among the present family of musical instruments accepted by the rank of players. Lyon & Healy, Inc.

ELECTRIC HEATING ELEMENT WHICH will operate and interchange with base and cover of Imperial self-heating gasoline iron, $500. Imperial Brass Company.

DISCOVERY OF NEW USES FOR CARBONdioxide gas or improvements to present uses. Award $1,000.

FOR AN AUTOMATIC FREEZEPROOF SODA cooler adaptable to "iceless" type of soda fountains, $1,000. Above two problems by Liquid Carbonic Company.

$2,000 WILL BE PAID IN SEVERAL AWARDS for processes and machines for salvaging waste lumber. National Lumber Manufacturers' Association.

FOR SKYROCKET STICK HARMLESS IN descent, $1,000; bombshell with illuminated flag, $250; chemical combinations to produce smokeless fireworks colors, $250. Thearle-Duffield Fireworks Company.

MOTOR-OPERATED HANDSAW FOR MANUfacture and sales; award, $10,000 in royalties. R. L. Barker and Company.

$500 FOR SALES PROMOTION PLAN FOR absorbent, non-heat-conducting powder that can be used with other materials. The Keasby and Mattison Company.

ROYALTIES OF $15,000 WILL BE PAID BY the Aetna Industries, Incorporated, for improvements in their products or new articles they accept for manufacture and sales.

THE GEMCO MANUFACTURING COMPANY will pay $250 for suitable article they can make in their general metal-working plant.

FOR THE BEST SUGGESTED IMPROVEment on a gasoline-heated blowtorch and soldering and branding iron combined an award of $500 will be paid by the Everhot Manufacturing Company.

AWARDS OF $500 EACH WILL BE PAID for a waterproofing process for a library paste and a method that will produce increased sales of this product. John J. Harris and Company.

$2,000 WILL BE PAID BY THE NORTH Shore Food Products Company for a method of processing or preserving cottage cheese to keep it fresh for at least two weeks.

THE CARR FASTENER COMPANY WILL pay $500 for a reservoir grease cup which can be filled with a grease gun and feed out the grease at a slow rate.

FOR NEW WAYS OF USING BUTTON molds $500 will be paid by donor in Problem HA-1, and the same concern will pay $500 for new uses for button-mold machines as stated in Problem HA-2.

A SLOGAN AND SALES PLAN IS WANTED by the Casmine Company for a medicinal ointment. They will pay the sum of $250 for those accepted.

TO THE PERSON SUBMITTING TO THEM an article which they can make in their machine and electrical shop, the Guyan Machine Shops will pay $250 over and above its royalties or sales price.

THE BENJAMIN ELECTRIC MFG. COMPANY will pay $250 for fitting stand lamp clusters to old vases; $150 for most practical method of using electric shop materials for lamp stands and $100 for business boosting scheme.

MANUFACTURER MAKING BENT WOOD rims for wheels offers $5,000 for proposition by which output can be taken up by other needs and uses. See Problem LR-2.

FOR ACCEPTED IDEAS FOR NEW USES OF fans, blowers, shutters, and unit heaters Ilg Electric Ventilating Company offers $5,000 in various awards.

FOR A PERFECTED METHOD BY WHICH finished silver can be coated or treated to prevent tarnishing, the Stieff Company offers the sum of $1,000.

TO ANYONE WHO WILL PRODUCE FOR them a saxophone reed to satisfactorily replace the present reed, the Buescher Band Instrument Company will pay the sum of $1,000.

THE PHENIX RADIO CORPORATION WILL pay the sum of $1,000 for the design of a new form of condenser for radio reception.

FOR A SATISFACTORY HAMMER-BLOW arrangement for a portable hammer drill, the Wodack Electric Tool Corporation will pay the sum of $500.

DONOR IN PROBLEM PD-1 DESIRES A DEsign for a starting switch for an alternating-current motor and will pay $100 for the one accepted.

THE SUM OF $50 IS OFFERED BY THE Parsons Manufacturing Company for the best plan they receive for uses of ground slate.

FOR A SIMPLE DESIGN OF A 2-KW. MOTOR generator set, or rotary converter and one which this concern will accept, the William H. Mitchell Company will pay $500.

PERFECT IMPROVEMENT IN PROCESS OF color separation employed by engravers, $500. Jahn and Ollier Engraving Company.

$1,000 IS OFFERED BY MR. FRANK LESH for a detonator for explosives that set off a charge under water or oil without need of connecting lines.

Full Details Regarding the Previous Offers Listed Above, May Be Obtained by Addressing the Bureau of Information, Popular Mechanics Magazine

YAY—a touchdown!

Mickey over the line! Listen to 'em cheer! 'Ray—Mick! Thousands at the game. Hundreds of thousands listening in! Everybody's eager—excited—keeping young with new enthusiasms. Listening in!

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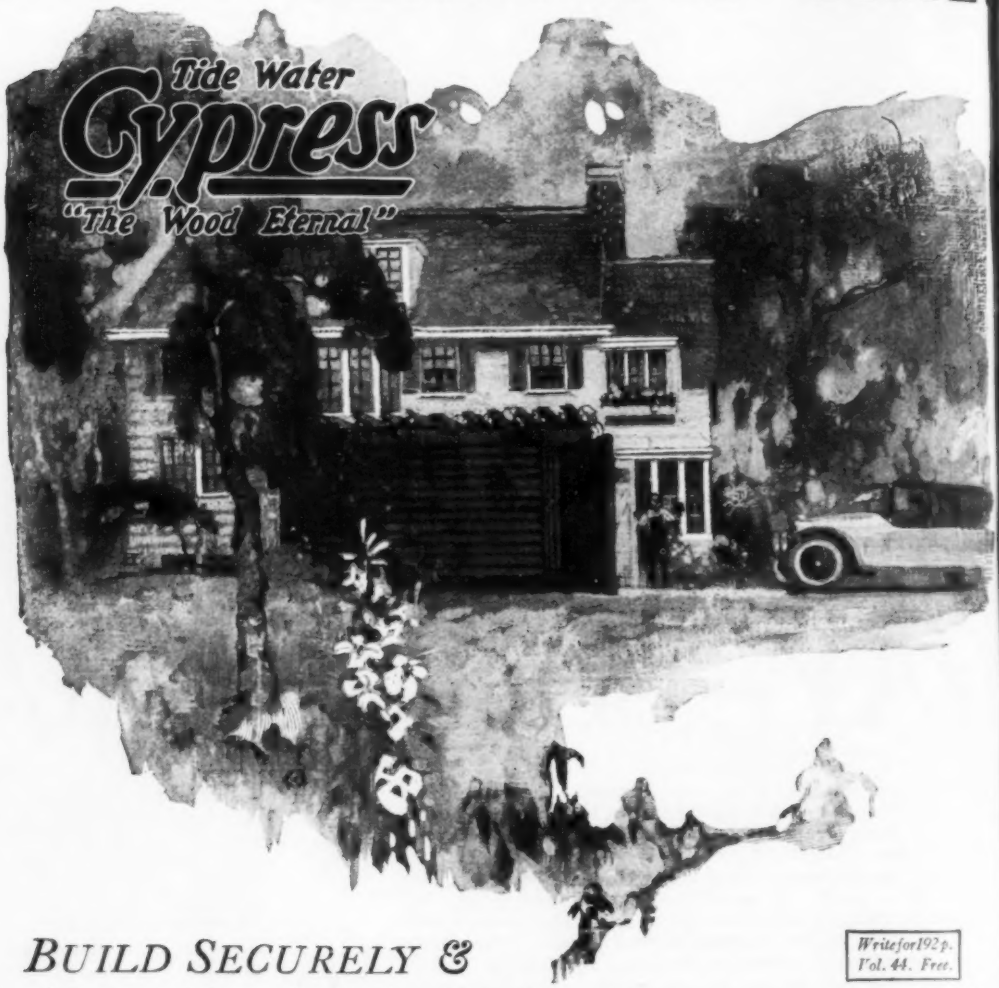

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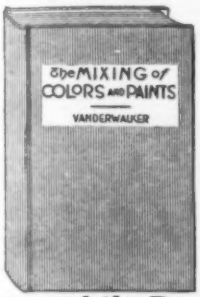

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How much are you paying to stay untrained?

The other day we received a letter which every man working for a living ought to read—whether he's making $20 a week or $200. Here it is:

"During the forty years that I have been working, my salary has averaged less than twenty-four dollars per week with the exception of the last two years while I have been acting as foreman of a department. I made good in this position on a small scale and saw, thru the failings of others, what would happen to me unless I found a way to train for larger responsibilities.

"I had read of correspondence courses and began searching for that which I thought would benefit me. I found it in the LaSalle Modern Foremanship course, and benefited by it, my salary being nearly doubled, and I was promoted from foreman to factory superintendent.

"This happened in a period of about ten months, and by devoting only about four or five hours per week to the studies.

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"I regret that I put it off to so late a day in life to reap the benefits I am now enjoying, and can truthfully say to younger men that if they would only profit by the experience of others they can gain more knowledge thru one year's training by LaSalle methods than can be obtained in ten years' practical experience by hard work."

SHERMAN C. WOOD, Maryland.

We quote the above letter not because Mr. Wood is now making a staggering salary as a result of his training, but because it illustrates so clearly the principle behind LaSalle training.

Here is a man who all his life had accepted the thought that he was compelled to work for little or nothing.

For one thousand, nine hundred and seventy-six weeks the writer of this letter *paid at least $24 a week for the doubtful privilege of staying in the ranks of untrained men.*

Can anyone doubt that training would have doubled his salary just as easily when he was thirty-eight years younger—when he could attack his work with the abundant energy of a younger man?

Yet his neglect of this one main avenue of business progress cost him—leaving simple and compound interest out of the reckoning—the appalling sum of $47,424—a fortune in itself.

If You Could Use $47,424, Pause Before You Turn This Page

Perhaps you are now making quite as much as Wood—perhaps more. Perhaps, on that account, you may think that Wood's experience does not apply to YOU.

But if training in Higher Accountancy—or Modern Salesmanship—or Business Management—or Law—or Business Correspondence—or any of a dozen other branches of business could change your forty-eight dollars into *$96 a week*—and if you now NEGLECT to advance yourself thru the training you need—will you not find it difficult, thirty-eight years from now, to explain to those who are dear to you why you threw away—not $47,424, but *fully $95,000?*

We're not going to moralize. We're not even going to cite you any of the thousands of letters from men who have not merely doubled but tripled and quadrupled their incomes thru home-study training under the LaSalle Problem Method. We *have* the letters. We will *show* them to you, if you like. But understand, please, that they would not *alter* the facts—they would merely *emphasize* them.

Below this text there's a coupon.

We believe that if you will re-read that letter from Sherman C. Wood and will face your problem of advancement squarely, you will not turn this page until you have clipped the coupon, filled it in, and by placing it in the nearest mail-box placed *yourself* on the road to real success.

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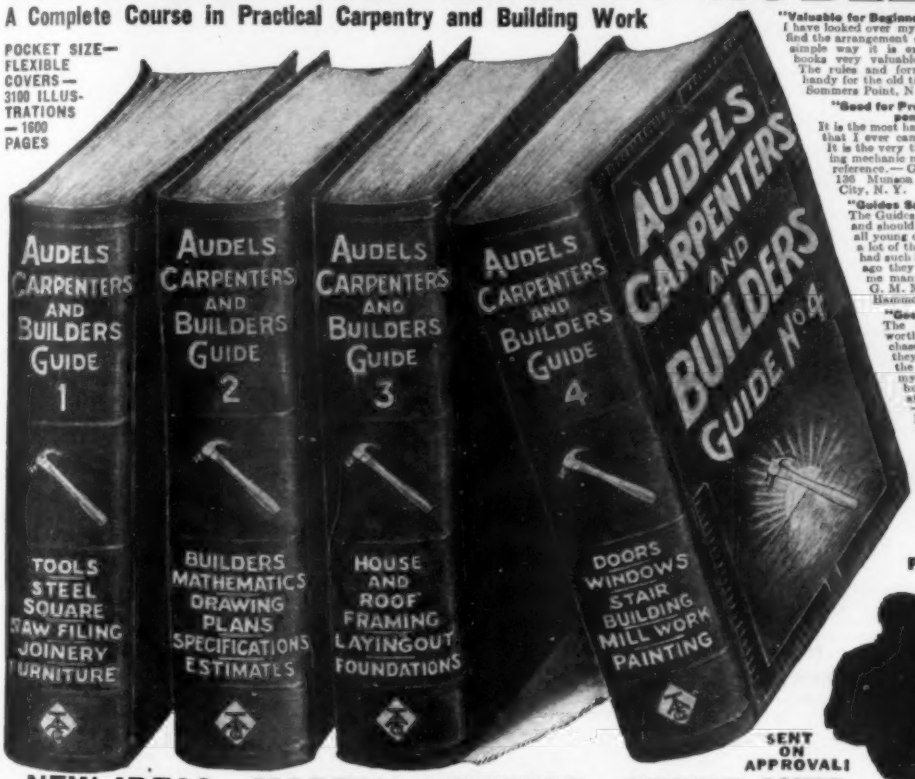

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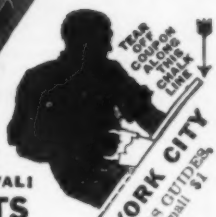

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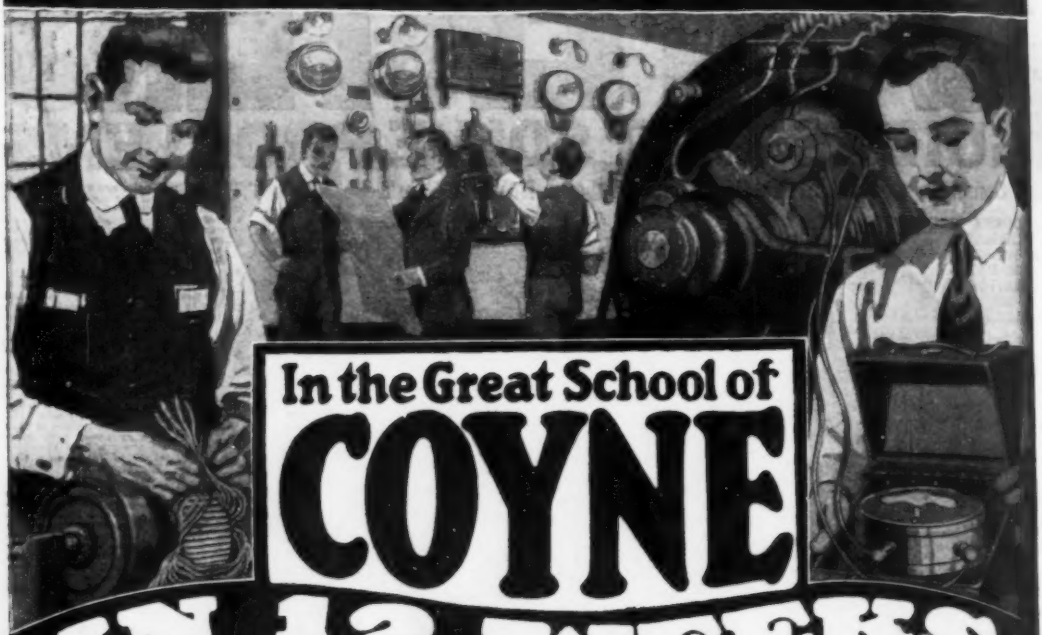

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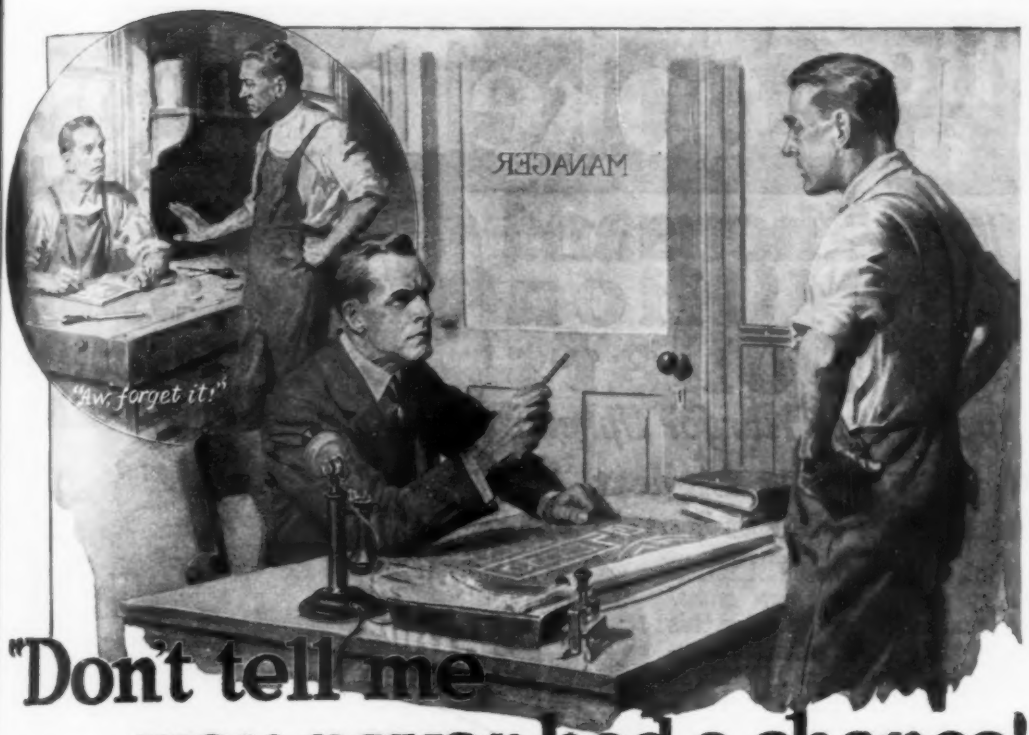

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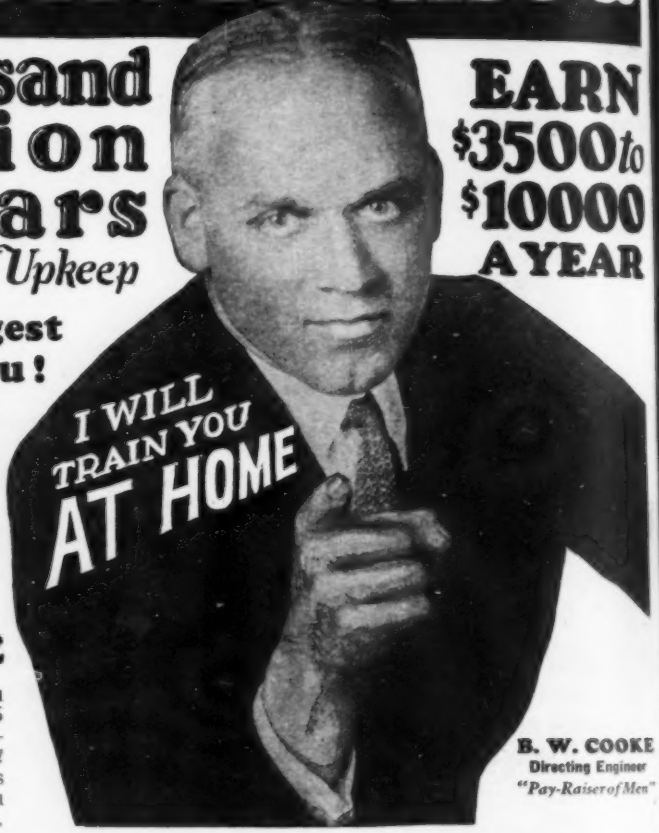

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"Wouldn't take $1000 for what I have learned," says Chris. F. Baden, Spangle, Wash., who has finished only half my training so far.

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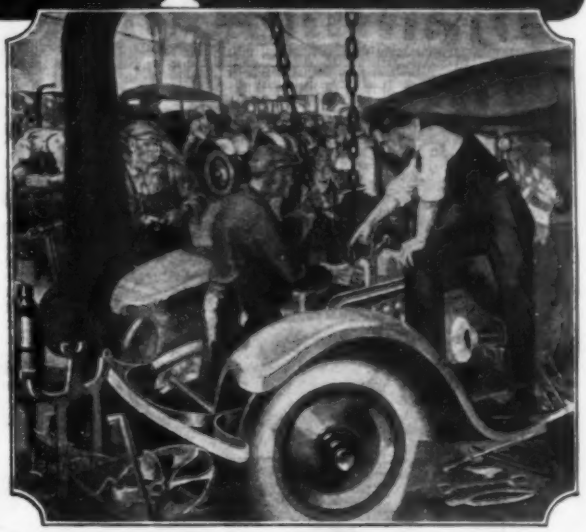

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I don't care how little schooling you have, I will make you a successful Auto Expert or refund your money! Boys and men of all ages have become Garage owners and managers, Superintendents, Foremen, Auto Experts, BIG PAY executives, with Cooke "JOB-WAY" training behind them. My book will prove to you that I will fit you to take advantage of the many wonderful opportunities of the great Auto Business!

Read My Guarantee!

Ten guarantees in my big free Auto Book. No. 1 is: *"I guarantee to refund every cent of your money if after receiving my training you are not absolutely satisfied."* This and nine other wonderful guarantees make my "JOB-WAY" course the training for you! Be sure to get my book and read all 10 guarantees—the most amazing protection offered by any school on earth!

FREE! 2 Big Repair Outfits

Tools and Test Bench Equipment FREE! *Many students earn these outfits to MAKE MONEY shortly after starting my training. Mail coupon for offer!*

Auto Book *free*

MAIL THIS COUPON FOR FREE AUTO BOOK

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Send me FREE Auto Book and proof that I can become an Auto Expert at home in spare time. Also send your special offer of 2 FREE outfits.

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Address Me Personally **B. W. Cooke** Directing Engineer
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1916 Sunnyside Avenue, Dept. 916 Chicago

$90 Drafting Course Drawing Table Drawing Instruments ALL FREE

Mail Free Coupon Below

Complete Set of Drawing Instruments *delievered at once.* Yes, I will give you complete drawing outfit, a regulation "Chief's Own" drawing table and, besides, give you an opportunity to get a $90 drafting course free of all money cost to you. The instruments I give are in a handsome high class, plush lined folding case. They are regular draftsman's working instruments. Besides I will give you absolutely free, a 20 x 25 inch drawing board, a 24 inch T square, a 12 inch rule, a supply of drawing paper, two triangles, a French curve, pencils, erasers and thumb tacks as soon as you become my student.

Salaries up to $250 to $300 *Per Month*

There is an urgent demand for skilled draftsmen. Companies are issuing calls every day for men to fill positions paying up to $250 to $300 a month. Work is light, pleasant and profitable; a trained draftsman can be reasonably sure of having a good job all the time.

"I instruct you personally:" DOBE, Chief Draftsman

Chief Draftsman *Will Instruct You Personally*

I am Chief Draftsman of a large and well known firm. I have been doing the highest paying expert drafting work for a quarter of a century and I know just the kind of training that is demanded from men who get big salaries. I train you by giving you actual, practical work, the kind you must be able to do to hold a permanent, big paying position. I give you my individual instruction. If your work is right, I will advance you rapidly. If it is wrong, I will show you where and make you do it right, and do all I can to make you an expert draftsman and designer in a short time.

I Guarantee to train you until you are holding a position paying up to $250 and $300 month.

Write Today Without Fail!

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Without any obligation on me whatsoever please, mail your book, "Successful Draftsmanship" and full particulars of your liberal "Personal Instruction" offer to a few students. It is understood that I am obligated in no way whatsoever.

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Send Coupon *For New Book*

Put your name and address on the coupon or a letter or a post card and send it to me today. I will send you absolutely free and postpaid, my new book "Successful Draftsmanship," and the great special offer that I am now making, on which you get the complete Draftsman's Working Outfit **absolutely free.** You assume no obligations of any kind in sending in the coupon. Get in line for a big paying position. Getting the book and full particulars of the special offer is the first step.

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Go Into ELECTRICITY!

The world's greatest, fastest growing, most fascinating industry will pay you $3500 to $12,000 a year when you are an ELECTRICAL EXPERT trained to BOSS electrical construction or electrical power plants, to direct the work of ordinary electricians. Prepare for these positions, at home in your spare time, with Dunlap JOB-METHOD training, the most complete and up-to-date home instruction in Electricity.

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Dunlap JOB-METHOD training is built around four complete Electrical outfits which I send you without extra charge. With these valuable instruments, tools and materials, you learn by doing actual Electrical jobs. You get the theory while getting the practice. My JOB-METHOD of instruction makes it easy for you to understand the most difficult subjects.

22 Electrical Engineers

from Westinghouse, General Electric, Commonwealth Edison, Western Union, and other great corporations helped me to build this wonderful home-study training. So in every department of Electricity you get your training from a *specialist* and an *authority!* These executives know what training you need to hold down the BIG-PAY positions in Electricity, and they give you just that training.

BOSS Electrical Jobs at $70 to $200 a Week!

New projects in Electricity total hundreds of millions of dollars. No other industry offers such a golden future to *trained* men, trained as I train you. Electricity rewards not only the occasional genius like Edison and Steinmetz. This giant business also pays rich prizes to thousands of men who master electrical principles as I help you master them in my JOB-METHOD instruction.

Mail Coupon Get $63 Scholarship FREE!

AMERICAN SCHOOL organized NOT FOR PROFIT, gives you the benefit of royalties, profits and other savings. Write me at once and save $63 cash. Get the facts and take advantage of my GUARANTEED JOB and RAISE offer. Get the facts about *your* chances in the Electrical business. Get my big, free catalog, see for yourself how quickly and easily you can get ready for Big Pay!

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Don't let lack of ready money or anything else prevent you from getting my training. As early as your eleventh lesson I train you to do Electrical and Radio jobs in your spare time—to earn enough money to pay for this course and have some left over.

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Please rush free book, guarantee of a job and 50% raise, $63 Free Scholarship offer and complete information.

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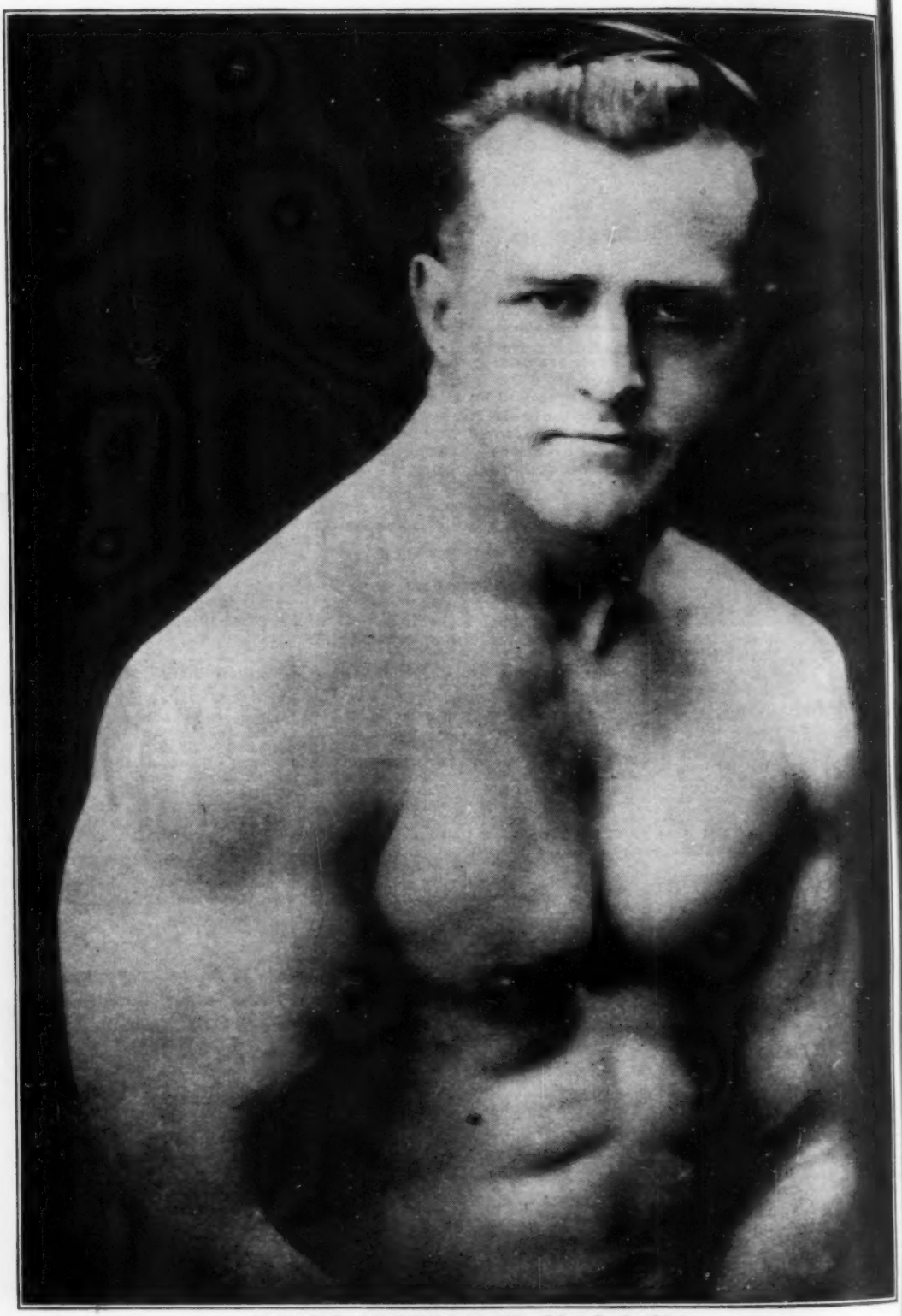
City.....State.....



EARLE E. LIEDERMAN, *The Muscle Builder*
Author of "Science of Wrestling," "Muscle Building" and "Here's Health"

Pills Never Made Muscles

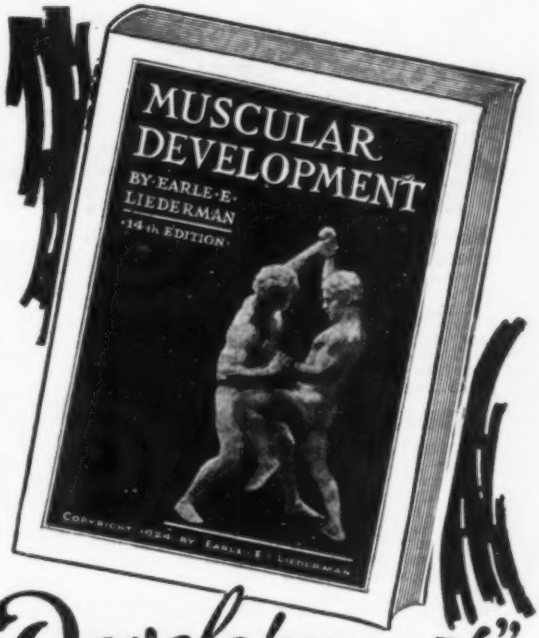
Wishing Never Brought Strength

NO one can paste muscles onto your arms and shoulders. If you wish a strong, healthy body, you must work for it. And if you don't have one, you are doomed to a life of misery.

Modern science has taught us that we must keep our bodies physically fit or our mental powers will soon exhaust themselves. That is why the successful business man resorts to golf and other active pastimes.

Examine Yourself

Do you have the strong, robust body that keeps you *fit* at all times to tackle the daily tasks confronting you—always looking for bigger things to do? Do you jump out of bed in the morning full of pep; with a keen appetite and a longing to enter the day's activities? Do you finish your daily tasks still thrilling with pep and vitality? Or do you arise only half awake and go through a languid day?



PEP UP!

Don't let it get you, fellows. Come on out of that shell and make a real *he* man of yourself. Build out those skinny arms and that flat chest. Let me put some real pep in your old backbone and put an armor plate of muscle on you that will make you actually thrill with ambition. I can do it. I guarantee to do it. I will put one full inch on your arm in just 30 days and from then on, just watch 'em grow. This is no idle boast. It's the real works. A genuine guarantee. Come on now. Get on the job and make me prove it.

Send For My New 64 Page Book "Muscular Development"

IT IS FREE

It contains forty-three full-page photographs of myself and some of the many prize-winning pupils I have trained. Some of these came to me as pitiful weaklings, imploring me to help them. Look them over now, and you will marvel at their present physiques. This book will prove an impetus and a real inspiration to you. It will thrill you through and through. All I ask is 10 cents to cover the cost of wrapping and mailing and it is yours to keep. This will not obligate you at all, but for the sake of your future health and happiness, do not put it off. Send today—right now, before you turn this page.

EARLE E. LIEDERMAN
Dept. 2012, 305 Broadway, New York City

EARLE E. LIEDERMAN
Dept. 2012, 305 Broadway, New York City

Dear Sir:—I enclose herewith 10 cents for which you are to send me, without any obligation on my part whatever, a copy of your latest book, "Muscular Development." (Please write or print plainly.)

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to give you personal, individual training in every branch of Dental Laboratory work, to make you expert in a few months!

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Where else can you earn such large salaries after only a few months of training? My training is the quickest way to BIG PAY. At my schools you become Expert in EVERY BRANCH of Dental Laboratory work, not merely skilled in some one part of it. That is why you will read letters in my book from McCarrie graduates telling of winning wonderful successes and enormous salaries.

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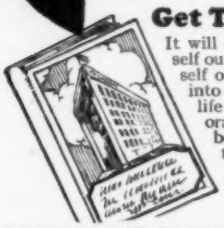
Get This Book Quick!



It will show you how to pull yourself out of the rut, how to lift yourself out of small pay, hard work into the fascinating, professional life of the well paid Dental Laboratory Expert. You need this book if you are earning less than $75 a week and want to make *something* of your future. Coupon brings it, *mail it today!*

With my training any fellow with a little mechanical ability can become a Dental Laboratory Expert *in a few months!* Here is a growing, uncrowded business calling for more experts than it can find—men trained as I will train you to make Crowns, Plates, Bridges, etc., for Dentists. This work is interesting, clean, easy. Salaries $75 to start up to $125 and more per week for EXPERTS. Why don't you investigate the wonderful opportunities of this profession and break away from poorly paid *harder* work?

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In Chicago (and Detroit) any ambitious fellow can *with my help* find a well paid position which will enable him to attend my schools evenings. Hundreds now at my schools, hundreds who have graduated have done this. Others go to my schools days and work evenings.

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Don't let lack of ready money keep you back. *I will help you.* When you mail coupon for complete information, be sure and tell me what kind of work you are interested in, so I can arrange to place you at once when you arrive.

This is Not a "Correspondence" School. You Learn Here by Doing Actual Dental Laboratory Jobs

This picture shows how I train my students. No classes, no text-books. You learn on actual "cases" from ethical practical Dentists, you learn with standard instruments on actual materials at my schools. Individual, personal instruction, intensive methods, enable you to become expert in every branch of Dental Laboratory in only a few months. My schools at Chicago and Detroit are the largest and best equipped Dental Laboratory schools in the world, and my graduates are the most successful.

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1. R. R. Fare to Chicago or Detroit
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In order to encourage more men to go into Dental Laboratory work and meet the big demand from Dentists and Laboratories *I am making extraordinary inducements right now!* Even if you have only common schooling, no matter what your age, get all the facts about this wonderful business and my remarkable offers *quick.*

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McCarrie Schools of Mechanical Dentistry

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Send me your three free offers and your Book without cost or obligation. Tell me about the Dental Laboratory business and the training you give at your schools.

☐ I attach letter stating the kind of work I am interested in while training at your schools.

.....Name

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I Tell You

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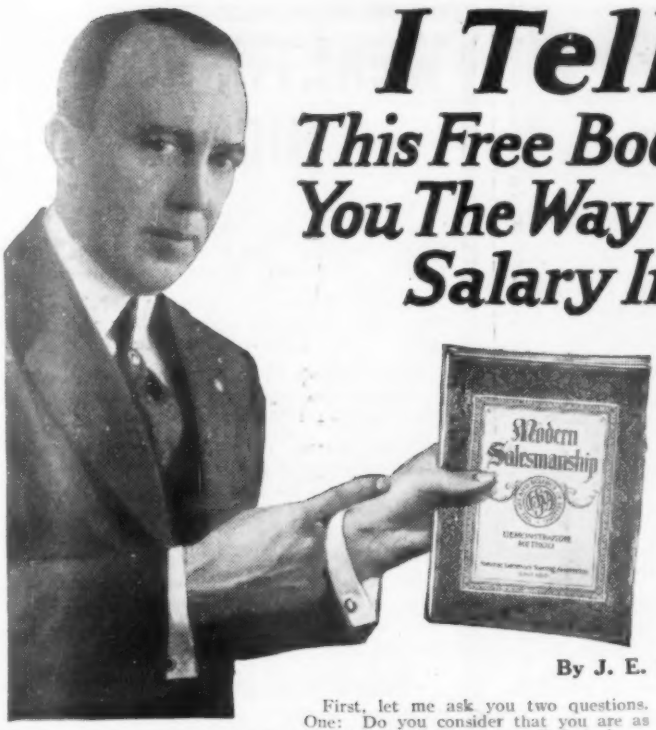

I only ask that you risk two cents on the strength of my word that the contents of this amazing book will show you the way to a prosperity that you never dreamed possible, in a fascinating field that you never thought of entering. This book is now free. Read my offer.

By J. E. GREENSLADE

First, let me ask you two questions. One: Do you consider that you are as intelligent as the average mail-clerk, farm-hand, office clerk, mechanic, or bookkeeper?

Second: If you suddenly found yourself with all the money you needed to spend, wearing the best clothes, living in a fine neighborhood, driving a good car and belonging to the best clubs—but having to make good in a job that paid $10,000 a year, would it scare you? There are men to whom $10,000 a year is so much that the idea of earning it themselves never occurs to them. They will always be in routine jobs at low pay. Their dreams will never come true. But yours will if you will absorb what I am going to tell you.

Now, in one quick step you can enter the field where opportunities in your favor are ten to one—the Selling field. You know that Salesmen top the list of money-makers—that the salesman is his own boss—that his work is fascinating, interesting and highly profitable! But the thing you doubt is your own ability. All right, but you can become a first-class money-making salesman in an amazingly easy way.

Proof That Salesmen Are Made —Not "Born"

The story of six men who once thought salesmen were "born," who did not believe they were "cut out for selling," is on this page.

Thousands of men like these six men who formerly thought salesmen were "born," are now enjoying magnificent earnings in the selling field. They were bookkeepers, mechanics, farmers, clerks—even doctors, lawyers and ministers—but in a few months after writing to the National Salesmen's Training Association they were out in the field selling—and making more money than they had ever hoped to make.

Sounds remarkable, doesn't it? Yet there is nothing remarkable about it. Salesmanship is governed by rules and laws. There is a certain way of saying and doing things, a certain way of approaching a prospect to get his undivided attention, a certain way to overcome objections, batter down prejudice, and overcome competition.

Just as you learned the alphabet, so you can learn salesmanship. And through the NATIONAL DEMONSTRATION METHOD—an exclusive feature of the N. S. T. A. System of Salesmanship Training—you gain actual experience while studying.

Years of Selling Experience in a Few Weeks

The N. S. T. A. System of Salesmanship Training and Employment Service will enable you to quickly step into the ranks of successful salesmen—will give you a big advantage over those who lack this training. It will enable you to jump from small pay to a real man's income.

Remarkable Book, "Modern Salesmanship," Sent Free

With my compliments I want to send you a most remarkable book, "Modern Salesmanship."

It will show you how you can easily become a Master Salesman—a big money-maker—how the N. S. T. A. System of Salesmanship Training will give you years of selling experience in a few weeks; how our FREE Employment Service will help select and secure a good selling position when you are qualified and ready. And it will give you success stories of former routine workers who are now earning amazing salaries as salesmen. Mail the coupon today. It may be the turning point in your life.

National Salesmen's Training Association
Dept. 12-W 53 W. Jackson Blvd. Chicago, Ill.

National Salesmen's Training Association Dept. 12-W, 53 W. Jackson Blvd., Chicago, Ill.

I simply want to see the facts. Send me free your book, "Modern Salesmanship," and Proof that I can become a Master Salesman.

Name.....

Address.....

City.....State.....

Age.....Occupation.....

READ!

$12,000 a Year
A. H. Ward, Chicago, held a small-pay job. Now he averages $12,000 a year as a salesman.

$100 a Month to $100 a Week in Only 3 Months
H. D. Miller, another Chicago boy, was making $100 a month as stenographer in July, 1922. In September, 3 months later, he was making $100 a week as a salesman.

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W. P. Clenny, of Kansas City, Mo., stepped from a $150 a month clerkship into a selling job at $500 a month. In one month he made $850.

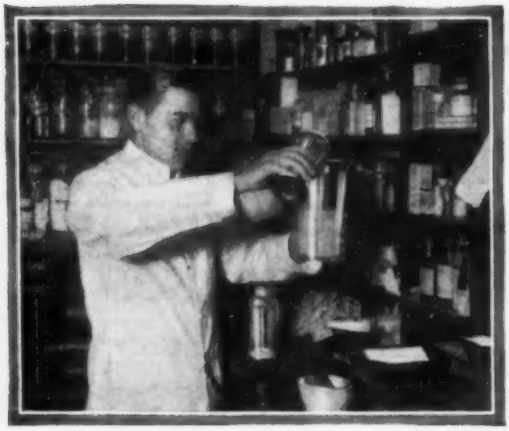
$6,500 a Year
M. V. Stephens, of Albany, Ky., was making $25 a week. He took up this training and now makes five times that much.

Small Pay to Big Earnings
J. H. Cash, of Atlanta, Ga., exchanged his $75 a month job for one which pays him $500 a month.

Now Sales Manager at $10,000 a Year
O. H. Malfroot, of Boston, Mass., stepped into a $10,000 position as a SALES MANAGER—so thorough is this training. All these successes are due to this easy, fascinating and rapid way to master certain invincible secrets of selling.

EMPLOYERS

are invited to write to the Employment Dept. of the N. S. T. A. We can put you in touch with just the men you need. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group Plan of instruction for entire sales forces. Synopsis and charts sent without obligation.



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Graduate pharmacists are always in demand. The work is interesting and pleasant and salaries are good. Many young men open drug stores of their own and become independent.

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Just mark and mail the coupon printed below to the International Correspondence Schools, Box 5657-D Scranton, Pa., and full particulars about the Pharmacy Course or any other work of your choice will come speeding to you by return mail.

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Street
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City.....State.....

Occupation.....

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Do not depend upon opportunity or intellectual brilliancy of any kind, because it is well known that uneducated people often acquire great wealth, while cultured and talented people remain in poverty.

Again, they do not depend upon capital, because many men with capital lose what they have, while others with no capital acquire phenomenal wealth.

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This may seem "too good to be true," but if you will consider that by the touch of a button or the turn of a lever science has placed almost infinite resources at the disposal of man, it becomes evident that there may be still other laws not generally known which contain even greater possibilities.

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Remarkable new short-cut method teaches you how to play any musical instrument. As easy as A, B, C! No tricks—no "stunts" —no monotonous exercises! Yet you learn from regular music!

ALL your life you've wanted to play a musical instrument. And now at last—you can realize your ambition! Just choose your favorite instrument—the piano, the violin, the saxophone, whatever it may be—and then let the U. S. School of Music prove that you can learn to play it in an amazingly short time—*right in your own home—and without any private teacher.*

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If you can play a musical instrument—you will never feel "alone in a crowd." For as you dash off the latest song hit—or play some lovely melody from a well-known classic—you will be the very center of attraction. You will be flooded with invitations. You will meet influential people. The sooner you start upon this path to popularity—the sooner will you find a brighter and happier life.

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Send for our interesting *Free* booklet—it will give you all the details of this remarkable course. Don't hesitate because you think you have no talent. Thousands of our most successful students never dreamed they possessed the slightest musical ability until it was revealed to them by our wonderful "Musical Ability Test." Now many of them earn big incomes in bands, or orchestras, as music teachers, church organists, vaudeville artists, etc. Others use their music solely for personal pleasure and for the entertainment of their friends. But once you see how quickly and easily you can learn to play your favorite musical instrument through this startling easy way—you will not let another day slip by without sending for the course. So send for the Free Book *Now.* Mail the coupon to-day. U. S. School of Music, 712 Brunswick Bldg., New York.

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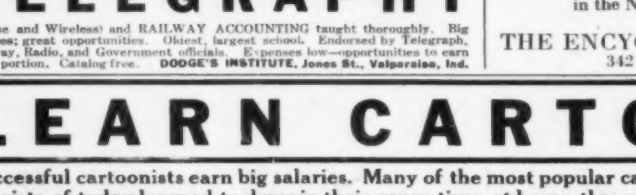

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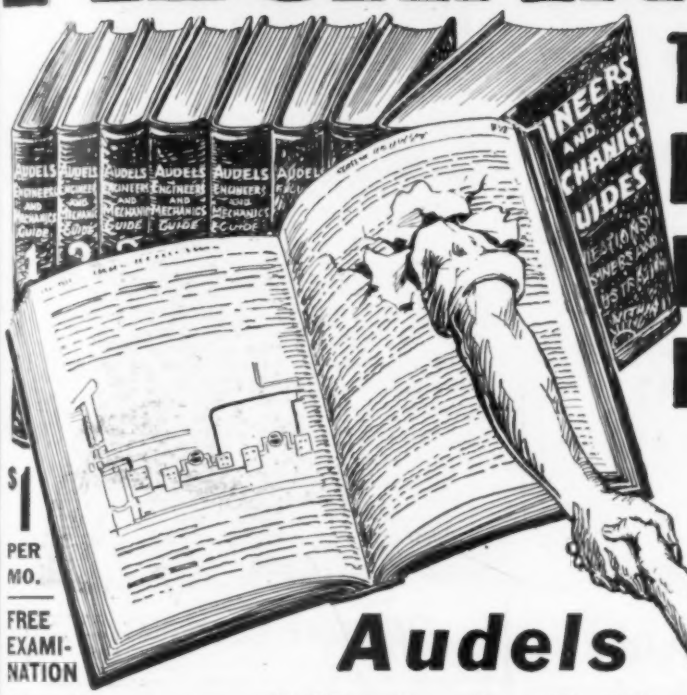

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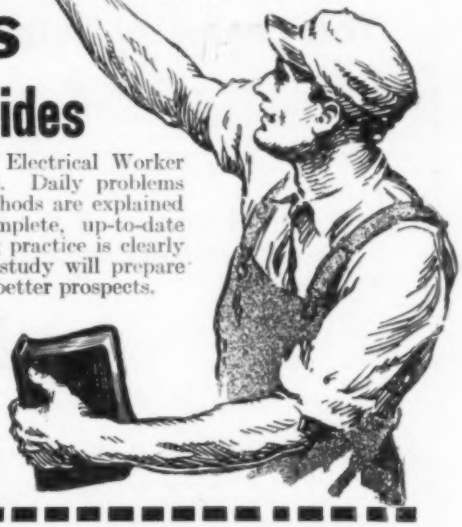

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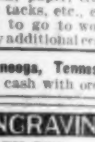

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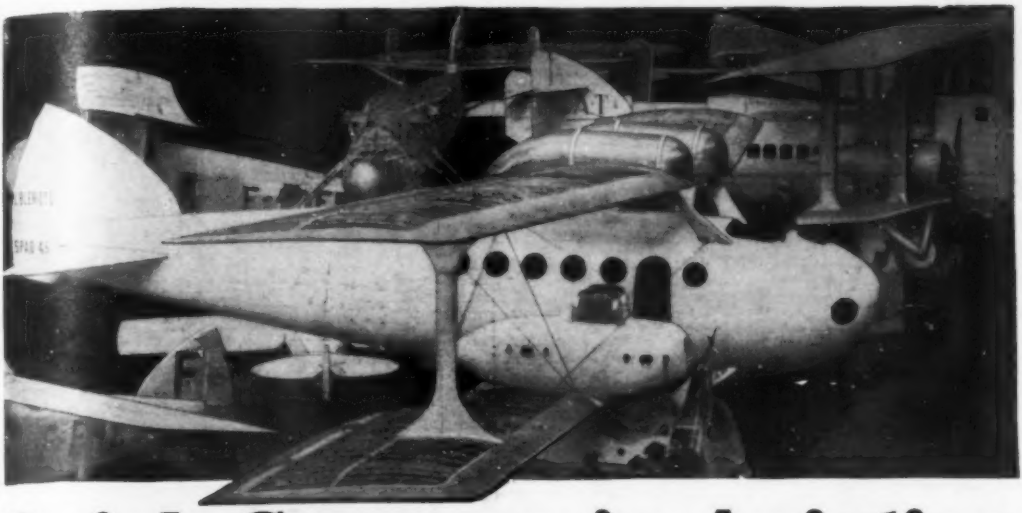

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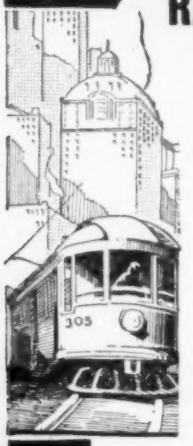

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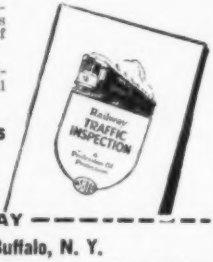

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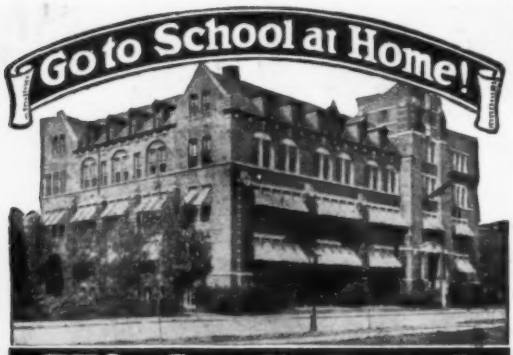

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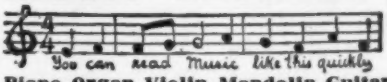

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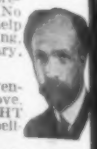

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LIVE Agents Make $10 Day selling Eureka Strainer and Splash Preventer for every water faucet. Takes on sight. Widely advertised and known. Get details today. A. B. Seed Filter & Mfg. Company, 73 Franklin, New York.

NO Steamy, Foggy Eye glasses or windshields from hot or cold weather if cleaned with Audrey's Stay-Clear. Sample 25c. Audrey's Agent Supply, Box 2091, Louisville, Ky.

SUCCEED With Your Own Products—Formulas By Experts. Manufacturing Processes. Trade Secrets. Different, Dependable, Profitable. Interesting Catalog Free. B. Thaxly Co., Washington, D. C.

MAKE Big Money Easy in your spare time. Double profits. New Self-Wringing Mop. Easiway Company, 405 St. Paul, Baltimore, Md.

AGENTS: Experience unnecessary. Sell Men's, Women's, Children's hosiery to consumer. 15c to $1.50 Pair. Big Profits. Samples furnished. Write Banner Hosiery, 182 No. LaSalle, Chicago.

AGENTS: Our guaranteed all wool tailor made suits and o'coats at $31.50 are $20 cheaper than store prices. Fall line greatest ever. Easy to sell, we train you. Comm. in advance. Write for great new sales plan. J. B. Simpson, Dept. 1020, 843 Adams, Chicago.

DON'T be an agent—Get my System and hire agents. Particulars free. Bazaar, 761 E. 47th St., Chicago, Ill.

BIG Money Now—Sells faster than ever—hard times improve sales. Darn E.-Z. Universal fabric Cement finds a buyer in every home, office, store and factory. New selling plan with every order. Darn E.-Z. Laboratories, Dept. P.M., Dayton, Ohio.

FREE Goods: Agents' headquarters; wholesale, any quantity, soaps, shampoos, creams, perfumes. Fastest selling combinations. Quickest money. $20 daily. American Preparations, Park Place, New York.

SELL Union Label All-Wool Made-to-Measure Suits direct to wearer for $24.50. Scott System Wholesale Tailors, 99M, Bedford Street, Boston.

MAKE $15 daily just taking orders for wonderful new coat; retails $6.50. Rainproof Mfg. Co., Parkersburg, West. Va.

THE Agent's Buyers' Guide tells where to buy everything. Copy, 50c. Wilson, Publisher, 1400 Broadway, New York.

AGENTS—$60 to $200 weekly putting up our Burnished Genuine Gold window letters. Experience unnecessary. Free samples. Premier Letter Co., 121 No. Francisco, Chicago.

DISTRIBUTORS Wanted — Men and Women. Staple Product, Quick Seller, Big Profit. Waxoline Laboratories, 549 West Quincy Street, Chicago, Ill.

$300 FIRST Two Weeks—made by Weigand, Johnstown, Pa., selling "Slide-O-Graf Jr." Novel, effective—sidewalk advertisement projector. Sells fast, big non-competitive field. $14 Profit every sale. Standard Slide Corp., 207 W. 48th St., New York.

SAFETY Comfort Seat for Cleaning windows, sells to every home and building where windows must be cleaned. Prevents danger and accidents. Big profit; quick sales, no competition. Super-Sete Mfg. Co., Dept. 46, 563 Fifth Avenue, New York.

AGENTS—No experience or capital necessary selling rubber goods demanded everywhere. Fancy Aprons, Women's Necessities, Baby Goods, Household Specialties, etc. Big Profits. Write American Rubber Products Company, Dept. 308, Pittsburgh, Pa.

$1—NECESSITIES—98c—Profit. Catalog—Dime. Moye Mfg., 1234 Clay, Paducah, Ky.

AGENTS Wanted—To distribute new Drug Preparation. Write for Territory. Walvem Co., 2340 Fullerton Ave., Chicago.

ANY man can easily make big money by addressing Consolidated Co., 632 South Dearborn, Chicago.

AGENTS Wanted. Men and Women. Exclusive territory. Marvelous new camera takes and finishes pictures inside camera in one minute. Wonderful opportunity. Crown Co., 909 Romax Bldg., New York.

AGENTS: Big Profits, Gold Sign Letters. Easily Applied. Samples free. Liberal offer to General Agents. Inter-State Sign, 3953 Armitage Ave., Chicago.

EMBOSSED Window Sign Letters. 1,000 for $9.75 1¾ inch, 2½ inch, 4 inch assorted. All guaranteed non-tarnishable and perfect cut. A bargain of course. 100,000 in stock. Foil Sign Works, 1965 Telegraph Ave., Oakland, Calif.

MANUFACTURE New Fast Selling Articles. Free list of plans, patterns, molds. K. Barter, 5937 Tracy, Kansas City, Mo.

MONEY from start. Household necessity. Invisible adhesive. Mends any cloth. Sensational seller. Repeats. Exclusive territory. Carson Supply Co., 332 Shukert Bldg., Kansas City, Mo.

AGENTS, make $20 a day selling novel advertising specialty. Every business man buys it. All or part time. Better than 40% commission. No investment required. It sells itself. Write for particulars. Commonwealth Specialty Co., 329 Main Street, Webster, Mass.

$75 A WEEK. Man or Woman Wanted with ambition and industry to distribute Raleigh's Household Products to steady users. Several fine openings in nearby cities and towns. We train and help you so you can make up to $100 a week or more. No experience necessary. Pleasant, profitable, dignified work. Write to-day. W. T. Raleigh Co., Dept. IL-8253, Freeport, Ill.

START a business of your own. Sell goods under your own private brand. Toilet articles, food products, household specialties. Tremendous profits. Big repeat business. We supply everything needed. Write for our attractive proposition. National Scientific Laboratories, 251 Monroe, Richmond, Va.

PATENTS. Write for my free Guide Books "How to Obtain a Patent" and "Invention and Industry" and "Record of Invention" blank before disclosing inventions. Send model or sketch of your invention for instructions. Promptness assured. No charge for above information. Clarence A. O'Brien, Registered Patent Lawyer, 589 Security Bank Building, directly across street from Patent Office, Washington, D. C. See pages 162 and 163.

TWELVE Beautiful Dollar Knit Ties, Special $4 per Dozen. Sent C. O. D. M. Zelin Co., 791 Farwell, Milwaukee, Wis.

AGENTS Wanted—Sell Treado, prepared rubber for filling holes in heels and soles or breaks in uppers of rubbers, tires, etc. Apply with knife, no cement, no soiled hands. Big profits, repeat sales. Treado Co., 238 East 45th St., New York City.

AGENTS: $50.00 Weekly Selling New Specialty; every merchant buys; sample 25c. H. A. Johnson, 1721 Ainslie St., Chicago.

AGENTS—Sell the Latest, Livest, Quickest selling specialties ever known. Make 200% profit. No competition. Practically every man and woman buys from two to six on sight. They can't resist. Act now. Get the Cream. Send 50c for three samples, one of which retails for $1.00. Hamilton Novelty Mfg. Co., 220-222 North State Street, Chicago.

ADVERTISING Novelty Pencils and Watch Charms with Microscopic Views enlarged 500 Times, 25c seller. Three Assorted Samples and Catalogue sent for 25c. Grandefeld, 1238 Theriot Ave., Bronx, New York.

ARE you old at forty? See our advertisement on page 192 of this issue. The Electro Thermal Company, 2137 Main St., Steubenville, Ohio.

IRONWEAR Suits $13.50. Never wear out. Working suits with style that sell. Get our agency. Good income. Write Ironwear Co., 293 Chauncy, Boston.

FOLD-HI-CHAIR Converts any chair into highchair for baby. Agents wanted immediately. Ganger Company, 3125 Essex Road, Cleveland.

$1.00 BRINGS Pound of Samples: Bonds, Banknotes, Coins; 10 Countries; 57 varieties; 200 pieces. Agents Cleaning Up. Hirschhill, 70 Wall St., N. Y.

AGENTS—Men and Women. 35 Million women are anxiously waiting to buy the 2 in 1 Hot Water Bottle—Icebag—Fountain Syringe combination. Commissions daily. No delivering. Write for startling money making plan. Lobi Manufacturing Corporation, Middleboro, Mass.

WANT Distributing Agents for Hanslick, the new original powdered handsoap. Removes grease, grime, ink, paint, and most anything from the hands without injury to skin. Every mechanic and auto-owner, everybody who gets his hands dirty, will be a customer. Great opportunity for hustler to get in business. Full information and sample free. Solar Products Company, A-124 West Lake, Chicago.

BOBBED hair has increased our sales. Crew-managers can make $6.00 per day. Kingsbury Company, Fort Wayne, Ind.

AT last! Complete home products. Folks want guaranteed spices, extracts, cocoa, baking powder, toilet articles, soaps, famous Edrings Herb Tablets. Catalogue. Jet. Pharmacal Company, Allentown, Pa.

$20 PROFIT daily selling needlebooks; costs 3c-5c each; sells 25c, value 50c; Three samples 25c. Catalogue Free. Needlebook Specialty Co., 661 Broadway, New York.

AGENTS: 500% profit. "Happy Home Maker Shampoo" builds your own big business. Martin of Indiana made $75.00 in one day. Missouri man made $750.00 one month. Exclusive territory. Geo. A. Schmidt & Co., 236 W. North Ave., Chicago.

AGENTS, $20 daily easy selling household necessity every woman wants. New invention reduces price. Big profit. Fagley & Halpen, 303 Cherry Street, Dept. 5, Philadelphia, Pa.

EXCLUSIVE agents $225 weekly. Genuine gold letters for store windows. Free samples; selling instructions. Chicago Window Sign System, 6226-A Kimbark Avenue, Chicago.

AT Last! Diamond Rival Discovered! Amazing blue white Rajah Gem astounds jewelry world and deceives experts! Beautiful Sample case Free! $100 weekly! Write Quick! Rajah Diamond Co., Dept. F-7, Salisbury, N. C.

BRING Home the Bacon—selling Stuart's Stain Remover. Removes ink, iron rust, grass and fruit stains. Write for free samples and terms today. C. H. Stuart & Co., 5967 Broadway, Newark, New York.

AGENTS—Sell Gloss Oil Veneer—The Wonder Polish. Cleans and polishes cars, furniture, etc. Sells in every home. Get your field at once. Duo Co., Dept. G1, Attica, N. Y.

"HOW to Sell Patents" free. Patent News-O, Washington, D. C.

ONE Dozen New Blades for Gillette Razor 50c Postpaid. Agents' Prices Only with Order. Hurry. Smith's Service, 1194, Wenatchee, Wash.

PORTRAIT Agents! Get busy on the biggest profit proposition you've ever seen! The new sensation in the portrait field—Artoil Portrait Paintings—exactly like oil paintings. Easy, big seller, great for "repeats." A "clean-up" in combination with famous P. & G. Photo Medallions. Write now. Pudlin & Goldstein, Dept. "A," 259 Bowery, New York.

ABSOLUTELY free box Bassett's Native Herbs sent to introduce. For Constipation, indigestion, headache, rheumatism. Big money selling, all or part time. Established 1879. Bassett, Dept. 8, Columbus, Ohio.

AGENTS—Wonderful opportunity, newest line Perfumes, Creams, Compacts, Soaps, Extracts, Remedies, Jewelry. Protected territory. Catalog free. Van Ogden, Inc., 1918 VanBuren, Chicago.

$35.00 PROFIT on $1.50 Outfit; Gold Monograms for Automobiles, etc. National, Station D, Brooklyn, N. Y.

YOUNG Men who want to make their spare time pay from $20 to $50 a week are offered an opportunity to sell an article which every man buys on sight, made by Ingersoll, the dollar watch man; retails for $1; you don't need to be a salesman; merely to show is to sell; big profits, quick sales and constant repeat business. Write today. Robt. H. Ingersoll, 476 Broadway, Dept. 206, New York.

AGENTS—Coin money selling our new fabric table cover; needs no laundering, housewives wild about them; send for free offer. Mfgr., Box 67, Medford, Mass.

"PEPPY-PORTER" Products—Necessities in every household. List of Formulas, Labels, Free. Monarch Specialties Co., 425 North Leamington, Chicago.

MAIL-ORDER Houses and Distributors: We pack French made beauty creams, face powders, perfumes, toilet preparations with your label. Chemist, 944A North Clark, Chicago.

MAKE extra money. Xmas postal, folder, tag combination packs, 10th season. Sell 25c. Sample 15c. Big profits. Ufert, 133 West 15th, New York.

WE Pay $36 a Week and expenses and give a Ford Auto to men to introduce poultry and stock compounds. Imperial Co., D-23, Parsons, Kan.

NEW Invention. Cleans whole house from cellar to attic, inside and out. All complete only $2.95. Over 100% profit. Write Harper Brush Works, 326 Grimes St., Fairfield, Iowa.

PUMSO, The fastest selling product on the market. Nothing else like it. Something entirely new. Make Big Money. Used by every auto-driver, mechanic, and necessary to every household. Repeat orders. A twenty-five cent article. Quick sales. Big Profits. Pumso Manufacturing Company, 128 West 75th St., New York City.

AGENTS: Imported Champagne baskets containing six bottles genuine French perfume. $3 value for $1.00. Sample postpaid 75c. Free particulars. Thayer, 729 S. Wabash, Chicago.

AGENTS' Side Line: Good Profits; New Novelty Game Just Out. Sensational Hit. Sample 35c. Kahn (Manufacturer), 99 Nassau Street, New York City.

SELL Beautiful $7.00 Red and Black Oversized hand made Fountain Pens for $3.50. Cost you $1.75. With bonus $1.55. Post card brings full details, or C. O. D. sample, at wholesale price. Johnson Pen Co., 117 So. First St., Rockford, Ill. Dept. P.

DASH control Gas Reserve Valves for Fords; $25.00 to $50.00 per day permanent income established; customers do the selling. Write today. The Will-Burt Co., Orrville, Ohio.

AGENTS—Be independent, make big profit with our soap, toilet articles and household necessities. Get free sample case offer. Ho-Ro-Co., 2725 Dodier, St. Louis, Mo.

$8 TO $16 daily easy—New Patented Cutlery and Carving Set—You take orders—We deliver and collect—Your Pay Daily—No experience necessary—Not for sale in stores—Full or spare time. Macochee Company, Stand 11012, Cincinnati, Ohio.

AGENTS wanted by Manufacturer of exclusive Novelty Knitted Sport Dresses and other knitted fabrics, selling direct to consumer. Attractive commission—large sample outfit free. Straightline Mills, Inc., 366 Broadway, New York City.

AGENTS and Side Line Salesmen wanted to sell the Easy Fill Gasoline Tank Cap and Gauge for Fords. A big proposition for live men. Write today. Easy Fill Cap Co., 929 Lawrence Ave., Chicago.

CAN you sell to colored people? Write, Eston Co., Dept. 101, 2509 Second Ave., Birmingham, Ala.

JEFFORDS sold 25 cans his first 4 hours; profits $7.50. Hundreds of others doing as well, or better. Particulars and sample free. Write today. The Mallard Chemical Company, Dept. EX, Saint Louis, Mo.

$8.00 TO $20.00 per day. A wonderful seller. Any man, woman, boy or girl can make big wages Selling Crimp Grip Clothes Line Fasteners. It is a perfect rope holder and can be used for many purposes. Crimp Grips are a simple, time-saving device. They last a life time and will not rust; it holds the line tight, and saves time on wash days. Every buyer is a booster. Send 50c for Mounted Sample and one pair of Crimp Grip Clothes Line Fasteners. Write for particulars. Crimp Grip Company, Belvidere, Ill.

$25.00 A DAY Easy! Best Line of Brushes on the market. 90 varieties, including famous Auto Fountain Washer. Excellent territory available. Write immediately. Philadelphia Brush Co., Dept. 25, Vineland, N. J.

WILLIAMS No Water Hand Soap, in tubes, has taken Auto owners by storm; washes dirtiest hands perfectly clean without water. Easy demonstration makes quick sales; 150% profit. Williams Co., Box 265, Montclair, N. J.

BIG Money selling new Household cleaner. Washes and dries windows. Sweeps, scrubs, mops. Complete outfit less than brooms. Over 100% profit. Harper Brush Works, 132 3rd St., Fairfield, Iowa.

AGENTS clear $50.00 weekly selling Opaline Portraits. Expense money advanced. Credit given. Big line now ready. Samples and Catalog free. Consolidated Portrait Co., Desk 2, Chicago.

AGENTS—Steady income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freeport Mfg. Co., 59 Main St., Brooklyn, N. Y.

SELL Shirts and Overalls direct to wearer. Big profits. Work full or spare time. No experience required. Big variety dress shirts with splendid line Union-made work and flannel shirts, overalls, coveralls and khaki pants. Write today for free selling outfit. The Nimrod Shirt Co., Dept. 8, 4712 N. Kedzie Ave., Chicago.

AGENTS—Steady income. Exceptionally useful Household Article. Handycap Co., Newark, N. J.

AGENTS Our new Fire Extinguisher sells for $4.95 with big commissions. Mechanically perfect—can't leak. Exclusive territory. Free outfit. Write. Nichols Co., Naperville, Ill., Dept. F. I.

AGENTS—line up with better Felt Rugs now. Our new rug novelties increase your income. Here's your chance! Newark Felt Rug Co., 27C, 16th Ave., Newark, N. J.

SPIRAL Curtain Rods and large line wire and metal specialties; get our latest price list. Hunt Mfg. Co., Box 1652P, Paterson, N. J.

AGENTS: Men and women, in spare or full time, make big money selling household necessity. Every home a prospect. Quick sales, big profit. Territory open. Write for particulars. Judd & Leland Manufacturing Company, Box 21, Clifton Springs, N. Y.

WONDERFUL Miniature X-Ray shows bones in fingers, lead in pencil, etc. Sells itself. Simply show it, everybody buys. Immense profit. Sample ten cents. Particulars free. Rialto, 1012-P Fitzgerald Bldg., New York.

AGENTS — Make $25.00-$100.00 weekly selling Comet Sprayers and Autowashers to Farmers and Autoists. All brass. Throws continuous stream. Established 30 years. Particulars free. Rusler Co., Johnstown, Ohio, Box C46.

WONDERFUL Scientific Discovery — "Sapphires," Blue White; also one Changeable Color, $3 per carat. Fire, Goldens, others $2. Rival Diamonds. Any kind of ring wanted—will quote wholesale. Wrist Watches, Pearl Ropes, Imitation Diamonds, Rings. Want Agents. Pauer (Importer), 152 Dewitt, Buffalo, N. Y.

HEATING with oil is in its infancy. Get in while the getting is good. Our burners make good. Agents wanted. Exclusive rights. Economy Oil Burner Co., 718-720 Second St., Webster City, Iowa.

SELF - THREADING Needles, Needle Books, Machine needles, find sales in every home. Fine side lines, easily carried, big profits, sample and catalogues free. Prentice Lee, 145 East 23rd St., New York.

AGENTS make 500% profit handling auto monograms, window letters, transfers, novelty signs. Catalog free. Hinton Co., 1153 N. Wells St., Chicago.

AGENTS—Three neckties, boxed singly $1.00. Retail $2.00, cash with order. Maxwell, 401 Searle Bldg., Rochester, N. Y.

MAKE $10.00 to $25.00 daily selling our Standard Books, Bibles and Testaments. Easy to sell. Big profits. Permanent position for responsible producers. Write National Book & Bible House, Desk 1, 36 S. State, Chicago, Ill.

BIG Money Selling Gold Initials. Quick Sales. Every Car Owner Buys. You Charge $1.50—Make $1.44 Every Sale. Your Profit $20 Daily. No License. No Experience. "Samples Free." NuLife (0) Monogram Company, Hartford, Conn.

AGENTS—Write for Free Samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn $100 weekly and bonus. Madison Mills, 564 Broadway, New York.

AGENTS—$10 to $25 daily. No investment. Free outfit. Best values. Largest commissions. World Raincoat Co., 659-B Morris Park Ave., New York.

AGENTS—$75.00 Weekly Selling Nustile Guaranteed Hosiery direct to wearer. Your pay daily in advance, we deliver and collect. All styles and colors. No experience necessary. Special extra monthly bonus. Sample outfit furnished. Write for particulars. Nustile Hosiery Mills, Dept. 175, Philadelphia, Penna.

EVERYBODY Buys new, instant stain and rust remover. For clothing, table linen, etc. Fine premium with every sale. Big, Quick Profits. Free Outfit. Write today. Christy, 51 Union, Newark, New York.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 404, Amsterdam, N. Y.

10,000,000 FORDS need "Teuscher" fan belts. 50% profit selling dealers; 250% selling owners. Write quick. Teuscher Belting Co., St. Louis.

BIG profits selling our practical patented specialties. Write for particulars. Welch Brothers Co., North Chicago, Ill.

CASH In on this quick seller. Wingo cleared $1,080 with Never Fail Razor Sharpener in six weeks; Purdy, $40.50 first day. Applewhite, also inexperienced, six orders in thirty minutes. No end to ready buyers. Exclusive territory for quick workers. Be first. Address Never Fail Company, 166 Allen Bldg., Toledo, Ohio.

AGENTS. Household necessity. Sells rapidly. Large Profit. Square deal. Premier Mfg. Co., Dept. 813, Detroit, Mich.

START a business of your own. Sell goods under your own private brand. Toilet articles, food products, household specialties. Tremendous profits. Big repeat business. We supply everything needed. Write for our attractive proposition. National Scientific Laboratories, 251 Monroe, Richmond, Va.

BIG Profits with Exclusive Territory—$50 to $100 weekly easy. More has often been made in one day's work. A hot or cold running water bath equipment for any home at only $7.50. No plumbing or water works required. Investigate. Send no money. Write today. Sanitary Supply Co., 721 Allen Building, Toledo, Ohio.

AGENTS—Good salary and commission selling "Ratskyll," new rat and mouse exterminator; ready for use; no bait required; non-poisonous; rodents die outside premises; no odor. Empire Specialties Co., 1549 N. Wells, Dept. 301, Chicago, Ill.

EASY, pleasant work for Mechanics, Shop Men, Clerks, during spare hours; will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. Novelty Cutlery Co., 67 Bar St., Canton, Ohio.

POLMET—The Wonderful Polishing Cloth that cleans all metals without liquid, paste or powder. Approved by "Good Housekeeping" and "Modern Priscilla"—sells fast at 25c. Sample free. Gale & Co., Inc., 15 Edinboro St., Boston.

AUTO owner tire agent wanted each locality to use and take orders for handmade Mellinger fabric and cord tires; guarantee bond 8,000 and 12,000 miles (no seconds); shipped prepaid on approval; get your tires free; no capital or experience required; make $100 to $300 weekly. Write for wholesale prices and sample kit. Address, Mellinger Tire Co., Dept. 200, Kansas City, Mo.

AGENTS—Clever Invention! Inkspoon makes every pen a fountain pen. Fast office seller; big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marul Company, Tribune Bldg., New York, N. Y.

AT Last—World's Greatest Adding Machine. Almost human. Retails $15; work equals $300 machine. $500 monthly easily made, demonstrating to stores, offices, garages, factories. Simple, easy; adds, subtracts, multiplies, divides automatically. Speedy, accurate, durable, handsome. Five year guarantee. Tremendous demand, amazing profits. Liberal trial offer. Protected territory. Write quick. Lightning Calculator Corp., Dept. F, Grand Rapids, Mich.

GET Our Free Sample Case—Toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. A, St. Louis, Mo.

AGENTS—Stamping names on Pocket Key Protectors; sample Check with your name and address, 25c. Stamping Outfits, Emblem Checks, Check Fobs, Name Plates. Hart Mfg. Co., Desk 2, 303 Degraw St., Brooklyn, N. Y.

125% CLEAR profit selling neckties; 2 samples $1.00; satisfactory or money refunded. Raymond Mfg. Co., 132nd St. and Madison Avenue, New York.

MAKE $17 daily—Finest Extracts, Food Products, Toilet Preparations, Household Necessities. Credit: Sample Case Free. Write for amazing offer. Perkins Products, B-6, Hastings, Nebr.

AGENTS: Big Money Monogramming by Transfer Method. Catalog Showing Over 50 Styles and Particulars Free. Motorists' Accessories Co., Mansfield, Ohio.

AGENTS: Big Profits. Best and cheapest window letters made. Easily applied. Dime brings five samples. Particulars free. Stairbite Co., 1115 Second Ave., New York.

MAKE $25 to $50 Week, representing Clow's Famous Philadelphia Hosiery, direct from mill—for men, women, children. Every pair guaranteed. Prices that win. Free book "How to Start" tells the story. George Clows Company, Desk 31, Philadelphia, Pa.

YOU can be your own boss with our Key-Check outfit. Good for $5 a day stamping names on pocket key checks, fobs, etc. Sample check with your name and address, 20 cents. Pease Die Works, Dept M, Winchester, N. H.

INSTANT Weld. Repairs largest punctures without cement or heat. Lenn's profit one day, $56. Write quick. Free sample; territory going fast. Tourists' Pride Mfg. Co., Desk T, Minneapolis, Minn.

EARN $10 daily silvering mirrors, plating and refinishing metalware, autos, chandeliers, bedsteads, headlights. Outfits furnished. E. Decie Laboratories, 1133 Broadway, New York.

AGENTS sell Wolverine Laundry S[illegible] Wonderful repeater and good profit ma[illegible] Free Auto to hustlers. Wolverine Soap [illegible] Dept. B37, Grand Rapids, Mich.

EVERYBODY uses extracts. Sell [illegible] Double Strength Extracts. Complete [illegible] household necessities. Big repeaters. W[illegible] today. Duo Co., Dept. E1, Attica, N. Y.

PATENTED Cigar Lighters with Gl[illegible] Advertising Front. Also Electric Cig[illegible] Moisteners. Wonderful Sellers. No Co[illegible] petition. Big Steady Profits. Proof, Co[illegible] Sales Plan Free. Drake Mfg. Co., Dept. [illegible] Milwaukee, Wis.

BIG Money and Fast Sales. Every ow[illegible] buys Gold Initials for his auto. You cha[illegible] $1.50; make $1.35. Ten orders a day ea[illegible] Write for particulars and free sampl[illegible] American Monogram Co., Dept. 40, E. [illegible] Orange, N. J.

IF you want good live agents—fellows [illegible] can get the business—ask me how others a[illegible] doing it. I'll gladly render the necessary a[illegible] sistance. Geo. F. Baker, Mgr. Classified A[illegible] vertising, Popular Mechanics Magazin[illegible] Chicago.

AGENTS—Send for free sample "Fretn[illegible] —washday wonder. You can clear at le[illegible] $20 to $100 weekly, according to spare [illegible] whole time. You don't have to talk; if [illegible] doesn't buy at sight, leave sample; she w[illegible] be looking for you long before you are a[illegible] to make the rounds again. Samples furnis[illegible] free. Premiums for your customers. Ex[illegible] sive territory. Credit given. Empire Spec[illegible] ties Co., 1549 N. Wells, Dept. 101, Chica[illegible]

BUILD permanent business. Men's, Wo[illegible] en's, Children's guaranteed shoes direct [illegible] wearer. A. P. Condon, Sales Manager All[illegible] Shoe Co., 110 Summer, Boston.

WE Start You Without a Dollar. Sou[illegible] Extracts, Perfumes, Toilet Goods. Exp[illegible] rience unnecessary. Carnation Co., De[illegible] 201, St. Louis.

TO secure agents or salesmen or for selli[illegible] farms and reaching investors, use classifi[illegible] (want) ads in largest newspapers and maga[illegible] zines. Price list No. 30 sent free. Ankru[illegible] Advertising Agency, 20 W. Jackson Blvd[illegible] Chicago, Ill. The largest classified advertis[illegible] ing agency in the U. S.

AGENTS—Men and Women. Establi[illegible] permanent business. 34c money order brin[illegible] can of Gravy Crystals, a wonderful Gra[illegible] and Stew improver. Try it and convin[illegible] yourself. Every Store and Home a prospe[illegible] New product with big future. Exclusi[illegible] territory to live representatives. Smith [illegible] Gray, Manufacturers, Guinda, California.

WONDERFUL! Startling! Amazing! O[illegible] Ex-Cel Luminous Crucifix and Magic [illegible] (Luminous) Necklace shine brilliantly in th[illegible] dark. Sell on first demonstration. Big profi[illegible] to you. Write for further particulars, or bette[illegible] still, send for sample and territory protecti[illegible] immediately. Crucifix $1.50, Necklace $1.[illegible] postpaid. W. G. Hannan Co., Dept. B, [illegible] E. 18th St., Chicago.

SELL the Livest, Quickest Selling Specialties Ever Known—Famous "Hahway" self-lighting pocket Cigar Lighters and Gas Lighters. Low Prices. Easily Demonstrated. Sell to Dealers. Employ Sub Agents. Exclusive Territory. Make over 100% Profit. P. Bernhardt, 148 Chambers Street, New York.

EARN big money fast applying gold initials to autos. Every owner buys—$1.[illegible] profit on $1.50 sale—particulars and samples free. Write quick. Lithogram Co., Dept. 17, East Orange, N. J.

HIGH GRADE SALESMEN WANTED

AGENTS: Our guaranteed all wool tailor made suits and o'coats at $31.50 are $[illegible] cheaper than store prices. Fall line greatest ever. Easy to sell; we train you. Comm. in advance. Write for great new sales plan. J. B. Simpson, Dept. 1021, 843 Adams, Chicago.

IF you are ambitious, not afraid of work, satisfied to make $60 to $125 per week, I can show you how. I have given hundreds of clean-cut earnest men heretofore making $20 to $25 a week the opportunity of achieving such results. I can do the same for you. Opportunity often knocks but once; heed it. Write me today. M. F. Bronner, Box 125, Essex Postal Station, Boston, Mass.

SALESMEN: Moccasin Footwear Made over Shoe-Shaped Lasts sells quickly for Street—Sport and Workman's use. Write for Manufacturers' Illustrated Book and leather samples. Large immediate commissions. Investigate this. Moccasin Footwear Company, 500 Fifth Avenue, New York.

FOUR $7.50 sales to merchants net you $20.00 daily. Sayers Systems, 2803 Sheffield Ave., Chicago, Ill.

SALESMEN Wanted—To interview furniture and department stores in their locality on a special proposition for reliable manufacturer. You can earn $100.00 a week or more, in full or spare time, on commission. Interesting, steady work. Write today for full particulars. The Marvel Company, Hammond, Ind.

MANUFACTURER of power specialties has several territories open for men calling on power plant trade. No other will be considered. If you are willing to work and are anxious to make some real money, answer with full particulars regarding self, which will be treated confidential. The Colossus Company, Inc., Box 71, Shreveport, La.

START a business of your own. Sell goods under your own private brand. Toilet articles, food products, household specialties. Tremendous profits. Big repeat business. We supply everything needed. Write for our attractive proposition. National Scientific Laboratories, 208 Monroe, Richmond, Va.

A PLUNGE Into Prosperity. That about describes your affiliation with the Alexander Publicity Film sales organization. Some representatives earn $25,000 a year. Attractive proposition. Field large, receptive. 35% average profit for you. If earning less than $50 daily write for plan and book "Salesmen, Roll Your Own." Alexander Film Co., 3589 S. Broadway, Denver, Colo.

EVERY Ford Owner in the World Wants This! The Hamer Visible Vaporizer guarantees increased mileage (3 to 8 miles per gallon), more power (20% and better), quicker pickup, no carbon, smooth running motor, less heat, longer life, more driving comfort. Sells $4.50; your commission, $3. Exclusive territory. Details and proofs. Visible Vaporizer, Dept. 19, Chamberlain, S. Dak.

SIDELINE salesmen make $100 to $200 monthly selling Insto Hand Cleanser to grocers, drug stores, garages and shops. Attractive proposition to retailer makes Insto easy to sell. Write for particulars. W. A. Marsh, Westfield, N. Y.

SALESMEN wanted as exclusive distributors on a new, marvelous pocket cigar lighter selling to stores. Write immediately for particulars and selling plans. Masterlite Co., 110 East 23rd St., New York.

SALESMAN: If you think in terms of $6,000 the first year write me personally. Strong line for retail stores. Nationally advertised. Established concern has unusual opportunity. Liberal weekly advance to producer. Geo. R. Williams, Mgr., 1922 Euclid Avenue, Cleveland, Ohio, Dept. 200.

SALESMEN—Sell Four Square suits, $12.50. All wool overcoats $19.50. Make $3.00 to $5.50 each sale. Five different patterns of cloth. Complete line, coats, vests, pants, riding pants, slip-ons, overcoats, caps. Three-day delivery. Write today. Stone-Field Corporation, X-2556 S. Wabash Ave., Chicago.

SALESMEN to make $24 a day selling Rainbow Electric advertising signs. A real proposition for real salesmen. Every merchant a prospect. Every sale a $4 profit. Sample outfit complete for $2.50; six for $12. Sales guaranteed. Exclusive territory when you earn it. Rainbow Electric Sign Co., 451 E. 86th St., New York.

MR. BRUSH Salesman: Old Established New York Brush Manufacturers require the service of men in all territories to sell their extensive line of Sanitary Twisted in Wire Brushes. We pay larger commission than any other Brush House in the Country. Write immediately for our proposition. Wire Grip Sanitary Brush Corp., 15 Mercer St., New York.

SALESMEN: Sell guaranteed shoes for men, women and children below store prices. $70.00 weekly easy. We deliver, collect. K-W Shoe Company, 4048 Harrison, Dept. 20, Chicago.

SALESMEN and District Managers to sell constantly used, repeating building specialties to factories, public institutions and building owners of all kinds. Products established over twelve years among thousands of largest users, including U. S. Government. Immediate big earnings and promotion with $100,000.00 company to ambitious capable men. Write at once. The Colorcraft Company, 871 W. 70th, Cleveland, Ohio.

ESTABLISHED national concern manufacturing high grade household specialty offers openings as managers to men who can organize specialty salesforce; exceptional earnings. Kitchen Kraft Company, West Bend, Wis.

SALESMEN make $75 week, no investment, no deliveries. Envelope Sealer, retails $3.50, sells on demonstration. Kendall Sealer Co., Dept. B-31, Jaffrey, N. H.

SALESMEN who are interested in putting themselves on permanently profitable basis should write us today. This is strictly business—not a "get-rich-overnight proposition." Product, nationally-advertised. Exclusive territory to high-grade men. CFSCO, 15 N. 10th St., Richmond, Ind.

SALESMAN: Wonderful new office specialty, sells 50 cents. Can you organize sales, employ salesmen? Big opportunity. Write Robinson Co., 250-36 Devonshire St., Boston.

DISTRIBUTORS—Screw-holding Screw Driver. Handiest Tool ever invented. Unlimited market. Tremendous demand! Big repeat earnings! Write Coburn Tool 736A, Boylston, Boston, Mass.

DISTRICT Managers—Wonderful envelope sealer, seals 3500 hour! Retails $4 only! Big repeats. Tremendous profits. Consolidated Co., Dept. QG, 100 Boylston, Boston, Mass.

EXCLUSIVE State Distributor—Big earnings. Newly invented pricing system, retails $4.90. Tremendous demand! Big repeats! Millen Mfg., Dept. BG, Colonial Bldg., Boston, Mass.

WANTED—Tailoring Salesmen, make $60 to $125 per week. Biggest merchants in many towns have started with our line. We are the largest made-to-measure tailoring house in the country, furnishing elaborate sample equipments, including 500 all-wool fabrics. You make your own profits from $8.00 to $15.00 on each order. Guaranteed absolute satisfaction, perfect fit, best workmanship, or no sale. Write for line and all accessories to be sent free. Tell us all about yourself. Address N. O. Perry, Sales Manager, Box 483, Chicago, Ill.

ASTOUNDING invention. Fords use kerosene, start instantly. Mileage doubled. Big profit. Super, 1306 Fondulac, Milwaukee, Wis.

SALESMEN — Sell "Amenz" made-to-measure and ready made shirts; wonderful features; highest commissions. Samples Free. Menzin Shirt Co., 481-J East Tremont Ave., New York.

EXCLUSIVE State Distributor, $10,000 yearly. Newly invented pricing system, retails $4.90. Tremendous demand! Big repeats! Millen Mfg., Dept. XE, Colonial Bldg., Boston, Mass.

DISTRIBUTORS, $10,000 yearly. Amazing new invention seals 3,500 envelopes hour! Retails $4 only. Tremendous demand! Consolidated Co., Dept. Z.O., 100 Boylston, Boston, Mass.

SALESMEN Wanted—Local or traveling, part or full time, to sell calendars, fans, fly swatters, brushes, rulers, etc. Our two hundred stock design paraffined signs, ice cards, etc., for all merchants. Fine side line. Liberal commissions. The Harrison Co., Union City, Ind.

A WONDERFUL Seller! Any man, woman, boy or girl can make big wages. Some agents make from $8.00 to $20.00 per day. Crimp Grip Clothes Line Fasteners are a simple, time-saving device for holding a rope—also used for many other purposes. It pays for itself quickly in time saved on wash days. No knots—it fastens and releases quickly. Every home a prospect. Every housewife who uses Crimp Grips—and there are thousands of them—is a booster. There is but one Crimp Grip. Write for particulars, or send 50c for one pair and a mounted sample, with full particulars to agents. Crimp Grip Company, Belvidere, Ill.

WERE You Ever Offered a Grocery Store? Our proposition is better. You can handle flour, canned goods, dried fruit, coffee and entire line of groceries as well as radio sets, paints, roofing and automobile oils and tires with no rent to pay; no money invested, take large orders from samples. Goods are guaranteed and proven quality. Selling experience not necessary. Steady, profitable work for "workers." Address Hitchcock-Hill Co., Dept. 226, Chicago, Ill. Reference: Any bank or Express company.

DOES Your Trade Use Salesboards? Send for free catalog. Finest and largest ever published. Big commissions! Lincoln Sales Co., Dept. L, 212 N. Sheldon, Chicago.

BEST Seller. Jem Rubber Repair for tires and tubes; supersedes vulcanization at saving of over 800%; put it on cold, vulcanizes itself in two minutes, guaranteed to last life of tire or tube; sells to every auto owner and accessory dealer. Get particulars how to make big money and free sample. Amazon Rubber Co., Philadelphia, Pa., Dept. 510.

THE Jackson Mfg. Co., 1331 16th St., Denver, Colo., has salesmen clearing as high as $85.00 daily selling their newly patented auto specialty. Write them for free sample and particulars.

DISTRICT Managers Wanted—Appoint Local Agents for us in your locality. No canvassing or delivering. $100.00 weekly easily made. Commissions advanced. Bob Russell, A-2307 Archer, Chicago, Ill.

MEN—Women—Sell rubber aprons and rubberized goods, direct from manufacturer; every woman buys—100% profits—big sales. Get our proposition first. P. M. Bresler Co., 414 Broadway, New York.

SALESMEN sell sales and order books, auto. reg. rolls and bill ladings. Large demand. Liberal commission. Wirth Sales Book Co., Dept. PM, Chicago.

$60-$200 A WEEK. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-B North Clark, Chicago.

MAKE $100 Weekly in Spare Time. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays $100 profit. No big investment, no canvassing. Sharpe of Colorado made $955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. Ozarks, 802 Washington Blvd., Chicago.

SALESMEN—Become Independent. Own your business; experience unnecessary; selling our $7,500 Accidental Death, $50 Accident, $25 Sick Weekly Benefits; $12.50 yearly; other amounts proportionate. Guaranteed steady income from renewals. $250,000 deposited Insurance Department. Registration Dept. A, Newark, N. J.

TRAVELING Salesmen calling on retail stores wanted by large manufacturer to sell unique line of business-boosting articles. Year round, fast selling, main or side line. If not earning $150 weekly, address Elsaser Works, 222 Charles St., Boonville, N. Y.

SALESMEN—Sideline pays five to ten dollars a day taking orders for Specialty printed gummed advertising and Match Box Stickers. Write for proposition, samples, etc., today. Beardsley's Printery, Rock Island, Ill.

$4.00 PROFIT on Every $5.00 sale. "Free Sample"—New Specialty. (Money Getter.) Every Storekeeper, Doctor buys quickly. Experience unnecessary. Territories open. Box 596, Hartford, Conn.

SALESMEN Can make $5.00 a day selling our Calendars, Pencils, Signs, Advertising Novelties, Yardsticks, Whistles, etc. Liberal terms. Sells entire year. Fine side line. Local and traveling agents. Model Calendar Co., Dept. 226, South Bend, Ind.

CALIFORNIA Rosebeads selling like hot cakes. Agents coining money. Absolutely new. Big profits. Catalog free. Mission Factory SP, 519 No. Halsted, Chicago, Ill.

HELP WANTED

HOME Employment—New fascinating easy work, experience unnecessary. Egyptian Art Craft (copyrighted) enables anybody to immediately make hundreds of original beautifully designed art pieces from Silk, Cotton, or Paper. Complete working outfit with instructions sent postpaid for 25c. Archibald Co., 246C, 5th Avenue, New York City.

HOTELS Need Trained Men. Nationwide demand for high-salaried men; past experience unnecessary. We train you by mail and put you in touch with big opportunities. Big pay, fine living, interesting work, quick advancement; permanent. Write for Free Book, "Your Big Opportunity." Lewis Hotel Training Schools, Suite A-351, Washington, D. C.

MEN: We will establish you in a permanent business paying big income. Your credit is good for merchandise people must buy every day. No special experience necessary. Write today for free booklet "McConnon's System." McConnon & Co., Factory M48, Winona, Minn.

U. S. GOVERNMENT Life Positions. Over 20,000 positions filled yearly. Steady work. Men—women, 18 up. $1140 to $2300 year. Railway Postal Clerks—City Carriers—Clerks, etc. Pleasant work. Influence unnecessary. Common education sufficient with our coaching. Experience unnecessary. List positions obtainable—Free. Write immediately. Franklin Institute, Dept. S-3, Rochester, N. Y.

MONEY Silvering Mirrors, Autolights, Radiators, tableware, stoves. Outfits. Methods Free. Sprinkle Plater, 288, Marion, Ind.

$133 MONTH. Railway Postal Clerks. 25 coached free. Write immediately. Franklin Institute, Dept. S-19, Rochester, N. Y.

FIREMEN, Brakemen, Baggagemen, Sleeping car, train porters (colored) $140-$200. Experience unnecessary. 810 Railway Bureau, East St. Louis, Ill.

LOCOMOTIVE Firemen for railroads nearest their homes—everywhere; beginners $150-$250 monthly; promoted, locomotive engineer, $3,000-$4,000 yearly. Best paying positions on railroads. Railway Association, Desk M1, Brooklyn, N. Y.

PERSONS Wishing Change of Work, Write Scott Wilkerson, Mills Bldg., Washington, D. C.

MEN. Railway Postal Clerks. Steady, $1600-$2300 year. 25 coached free. Write immediately. Franklin Institute, Dept. S-19, Rochester, N. Y.

AGENTS: $11.80 daily in advance (send for sworn proof) Introducing New Insured Hosiery—47 styles—35 colors—guaranteed seven months—Winter line now ready—No capital or experience required—You simply take orders—We deliver and collect (or you can deliver, suit yourself). Credit given—Pay You Daily—Monthly bonus besides. We furnish samples—spare time will do. Macochee Textile Company, Room 26012, Cincinnati, Ohio.

MEN! Chance to earn money. Experience unnecessary. Schlitz Co., 3703 Haverford, Philadelphia.

MEN—Women, 18 Up. Get Government Jobs. $95-$192 month. List positions free. Write immediately. Franklin Institute, Dept. S-19, Rochester, N. Y.

BECOME a Landscape Architect. Uncrowded profession of wonderful opportunity for money-making. Easily mastered by mail. Earn while you learn. Write for book. American Landscape School, 56-E, Newark, N. Y.

MEN wanting positions firemen, brakemen, colored train or sleeping car porters, write for application blank; experience unnecessary, first class roads, no strike. Name position wanted. Railway Institute, Dept. 35, Indianapolis, Ind.

GOVERNMENT Railway Postal Clerks, $133-$192 monthly. Many other openings, $1400 upward. Full information free. Write immediately. Chicago Civil Service College, A-11 Kesner, Chicago.

MEN to Build Radio Sets for me in spare time. Leon Lambert, 539-H Kaufman Bldg., Wichita, Kansas.

HUNDREDS Jobs. Become Expert Automobile Repairmen. $30 week. Sample lessons free. Franklin Institute, Dept. S 400, Rochester, N. Y.

BE a Forest Ranger, Postal Clerk or Carrier. Steady positions. Particulars free. Write Mokane, Dept. A-12, Denver, Colo.

CLERKS; for Government Postal and other good positions $1400-$2300 yearly. Experience unnecessary. Full particulars free by writing G. W. Robbins, Civil Service Expert, 411 Burchell Bldg., Washington, D. C.

GET a United States Government Position. Good Pay, Short Hours, Vacation, Sick Leave, Pension, etc. Prepare for Railway Mail, Post Office, Custom House, Internal Revenue, Rural Carrier or other branches. Examination all the time. Common education sufficient. Let our expert (Former U. S. Civil Service Secretary-Examiner) train you. Guaranteed Preparation. Write today for Free Booklet. Patterson Civil Service School, Dept. S, Rochester, N. Y.

MEN—Age 18-40, wanting Railway Station-Office positions, $115-$250 month, free transportation, experience unnecessary. Write Baker, Supt., 41 Wainwright, St. Louis.

$60-$200 A WEEK. Genuine Gold Letters for store windows. Easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 438-C North Clark, Chicago.

FINGER Print Experts—Excellent paying positions; particulars free. Finger Print Headquarters, 188 East 79th, New York.

SILVERING Mirrors, French plate. Easily learned; immense profits. Plans free. Address, Wear Mirror Works, Excelsior Springs, Mo.

OUR genuine gold window sign letters are an excellent money-making proposition for handy men. Slann Sign System, Bethune Ave. E., Detroit, Mich.

MAKE money writing Photo-plays; details free to beginners. No correspondence course. Producers' League, 230 Wainwright, St. Louis.

INVENTORS desiring to secure patents should write for our book "How to Get Your Patent," tells our terms and methods. Send sketch for our examination and instructions without charge. Randolph & Co., Dept. 418, Washington, D. C.

RAILWAY Postal Clerks. $1600 to $2300 year. Men 18 up. Steady work. Common education sufficient. 25 coached free. Write immediately. Franklin Institute, Dept. S-19, Rochester, N. Y.

EARN $10 daily silvering mirrors, plating and refinishing metalware, autos, chandeliers, bedsteads, headlights. Outfits furnished. E. Decie Laboratories, 1133 Broadway, New York.

ALL men, women, boys, girls, 17 to 65, willing to accept Government Positions, $117-$250 traveling or stationary. Write Mr. Ozment, 101 St. Louis, Mo., immediately.

STORIES, poems, plays, etc., are wanted for publication. Good ideas bring big money. Submit manuscripts or write Literary Bureau, 522, Hannibal, Mo.

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CORRECT, detailed, expert information, advice, promptly. Any subject, $1.00. International Information Institute, 15 Moore Street, New York.

BUSINESS SERVICE

DELAWARE Incorporator. Charters; Fees Small; forms. Chas. G. Guyer, 901 Orange St., Wilmington, Del.

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SIMPLEX Typewriters $5.00; Famous, $5.00; Remington, $12.00. Circulars stamp. Demeo, 114 Ford St., Providence, R. I.

TYPEWRITERS All Makes. Save one-half. Thoroughly rebuilt in our factory by the famous "Young Process." Fully guaranteed. Free Trial. We handle all standard makes. Cash or sold on easy terms. Write for Catalog. Young Typewriter Co., Dept. 502C, Chicago, Ill.

TYPEWRITERS—$20 up. Easy payments. Free trial. Paynee Company, Rosedale, Kans.

TYPEWRITERS All Makes; real bargains; guaranteed. Dees Typewriter Sales Co., Ada, Okla.

UNDERWOOD Typewriters — only $3.00 down. Easy monthly payments. Low prices at less than manufacturers. 10 days' free trial. Rebuilt, all worn parts replaced. Just like a new machine. 5-year guarantee. Write for big free catalogue C-151. Shipman-Ward Mfg. Co., 1519 Shipman Bldg., Chicago, Ill.

TYPEWRITERS, All makes, $15 up. Guaranteed. Write for our bargain price list and Free Trial offer. Department 16. Manufacturers Typewriter Clearing House, 193 N. Dearborn Street, Chicago.

TYPEWRITERS, all standard makes, $10 up. Fully guaranteed. Free trial. Write for complete illustrated lists. Northwestern Typewriter Exchange, 121 N. Francisco Ave., Chicago.

TYPEWRITING

MANUSCRIPTS, anything, accurately typewritten, 50c M. Author's Service, Branford, Conn.

PRINTING, ENGRAVING AND MULTIGRAPHING

1,000 CIRCULARS. Good Paper, 6 x 9, $4.00; 9 x 12, $7.00. Jupiter, Lancaster, Ohio.

FOOTE Prints anything. Send copy for estimate. Free Sample and price list. Foote Printing, 5706 Haltnorth, Cleveland, Ohio.

HAMMERMILL Bond—100 letterheads, 100 envelopes, 50 notesheets, $1.00. Samples Free. Opportunity Publishing Co., Dunkirk, N. Y.

500 LETTERHEADS — Envelopes $5.00. G. Opem, 106 Warren St., Watertown, Wis.

1,000 LETTERHEADS or Envelopes, $3.00. Sent Prepaid. Samples Free. Monitor Press, Morrisville, Pa.

EMBOSSED Business Stationery. Samples for Stamps. Daniels Company, Pittston, Pa.

50 NAME Cards 20c; with address, 30c. F. Shepard, Rome, N. Y.

PICTURES Make Printing Powerful. Cut Catalog 10c. "Superior," 1825 Roosevelt, Indianapolis.

ENVELOPE special—100, name and address printed 50 cents. Postpaid. Guy Sherman, Clinton, Iowa.

PERSONAL Greeting Cards—25 Beautiful "Steel engraved" Christmas cards, printed with your name, $1.50, envelopes included. Order early. Cole Bros., 400 South Halsted, Chicago.

250 FINE 8½ x 11 bond letterheads or 6¾ bond envelopes, $2.00; 500 either, $2.60; 500 business cards, $1.00. Todd Printing Co., 19 East Second Street, Cincinnati, Ohio.

GUMMED Labels! Advertising Stickers! Interesting Samples Free! Brush, Auburn, Nebr.

5,000 — 12-PAGE — 3 x 6 Folders $25. Arthur Machemer, Sinking Spring, Penna.

5,000 HAMMERMILL Bond Letterheads, $14.00; 10,000 — $24.00; 25,000 — $56.50; 0,000—$108.00; 100,000—$213.00. 8½x11 20lb. Envelopes to match, same price. William W. Webb, Salisbury, Md.

WE print Stationery, Booklets, Catalogs, Circulars. Samples. Commercial Press, Batavia, Ohio.

FREE Card Case with your name engraved in gold on case with each calling card order. 20 cards 30c, 100, 60c. Christmas cards a specialty. Samples free. Mail Order Printing Co., 3702 Oregon, St. Louis, Mo.

5,000 THOUSAND 20 lb. Hammermill Bond Letterheads $15.00. Printing Samples Free. Commercial Printing Company, 7002 N. Clark St., Chicago.

"NEARGRAVURE" Stationery—It's Different—Class—Moderate prices. Solliday's, Knox, Ind.

225 BOND letterheads, envelopes, billheads, cards, $1.25 each. Combination, $4.00. Economic Press, Leonia, N. J.

200 PRINTED 8½ x 11 Hammermill Letter-heads, Envelopes, Billheads or Business Cards $1.00. Postpaid. Race Printery, Hudson, N. Y.

250 LETTERHEADS, 250 white envelopes, printed and mailed, $3.00. Samples printing free. Sunco, Mohawk, N. Y.

QUALITY Printing! Reasonable Prices. Send for Free Standardized samples and prices. Folders, Circulars, Catalogs our specialty. Ernest Fantus, 525 South Dearborn, Chicago.

GILT lettered Advertising-Pencils for you. Buy direct; save entire middleman's profit. Samples free (no agents). Address S. Musiat & Co., 10-12 Lincoln St., Yonkers, N. Y.

250 BOND Letterheads, 250 Envelopes, $3.00. Samples. Midland Press, 543 West Hickory Kankakee, Ill.

BOND Letterheads—$2.00 per 500. Small size $1.50. Place, Harding, Mass.

MULTIGRAPHING. Prices lowest; let us quote. Printing. Walter Miller, Berwick, Pa.

PRINTING OUTFITS AND SUPPLIES

COMPLETE printing outfits, presses, type, ink, paper supplies. Write for Catalog. Press Co., C-11, Meriden, Conn.

PRINTING Outfits—Presses, type supplies, type novelties. Send stamp for catalogue. Model Press, York, Penna.

PRE-USED Printing Presses, Type and supplies. List for stamp. Popular Bargains, Richland, Pa.

DUPLICATORS AND DEVICES

"MODERN" Duplicators save Time, Labor, and Money. Gets business. Reproduces Typewritten or Penned Letters, Drawings, Lessons, Music, Menus, Bids, Notices, Specifications, Maps or anything in one or more colors. Prints Two per minute. Special Sale On. 30 Days' Free Trial. $6.60 delivered. Booklet Free. J. E. Durkin-Reeves Co., Ridgway, Pa.

STENCIL Duplicating Outfit—Typewriting, Handwriting. $2.50, $3.00, $4.00 Sizes. Returnable. Primos Specialty Co., 2-M Primos, Pa.

COMPLETE Multigraphing outfit—36—cheap. Habben, 816-18 Chestnut, St. Louis, Mo.

YOU can make 50 to 100 copies of a letter, notice, etc., at a cost of three cents on a Heyer Quality Duplicator. Write for free trial offer. The Heyer Duplicator Co., 14 S. Wells St., Chicago, Ill.

ADDING MACHINES

NEW $3.50 Automatic Adding Machine. Adds, Subtracts, Multiplies. Absolutely accurate. Capacity $999,999.99. Fully guaranteed. 75,000 pleased users. Makes adding easy, positive, quick. Eliminates Mistakes. Saves Time. Postpaid $3.50. Bassett Co., 1458-B Hollywood Ave., Chicago.

FREE Trial. Marvelous new Adding Machine. Adds, Subtracts, Multiplies, Divides, automatically. Work equals $250.00 machine. Price only $15.00. Speedy, durable, handsome. Five-year guarantee. Used by largest corporations. Write today for catalog and free trial offer. Lightning Calculator Co., Dept. E, Grand Rapids, Mich.

MAILING LISTS

RANCHERS, Stockmen make good customers. List $5 Per Thousand. Ad-Matter Distributed. James Mathews, Twin Falls, Idaho.

FOR SMOKERS

CIGAR Bargains. 50 44's or White Owls $3.35; 50 Harvesters, El Productos or Admirations $4.50. Prepaid in U. S. A. Economy Bulletin free. Richard Lavery, Asbury Park, N. J.

200 LUCKY Strikes, Camels, or Chesterfield Cigarettes $1.35. 600 divided into thirds or all one brand, $3.95. Holland, 53 Woodward Ave., Boston 19, Mass.

CIGAR Smokers! Factory to Smoker System Saves You Half; write for particulars and special offer. Montrose Cigar Factory, Dept. F, 4004 Montrose Ave., Chicago, Ill.

FOR MEN

CHRISTMAS Special! Genuine Calabash Pipes $2.00 prepaid. Booms, 5909 Wakefield, Cleveland, Ohio.

ARE You Old at Forty? See our advertisement on page 192 of this issue. The Electro Thermal Company, 2137 Main Street, Steubenville, Ohio.

200 LUCKY Strikes, Camels, or Chesterfield Cigarettes $1.35. 600 divided into thirds or all one brand, $3.95. Holland, 53 Woodward Ave., Boston 19, Mass.

CHRISTMAS Suggestion! Men's Imported Handkerchiefs, Warranted Pure Linen, 50 cents Each; Six $2.75. Postage and Insurance Extra. Irish Manufacture. Alexis Mengelle, Box 387, Colorado Springs, Colo.

BOATS AND LAUNCHES

16-FOOT Rowboat—easily made. Construction blueprint 30c. Weesho-Uco, 31st Office, Detroit, Mich.

BOATS that always go are propelled by Ford Engines. Ford engine booklet free to boat owners. Harry Rider, 201B East Avenue, South Norwalk, Conn.

SPEED boat for small engine. Plans and directions 25 cents. Free catalog of boat plans and books. The Rudder, 9 Murray Street, New York City.

NEW Boat Book telling how to make 21 kinds of boats. Also many other helpful ideas for those who like boats. Profusely illustrated. 50 cents. Popular Mechanics Press, Room 807, Popular Mechanics Building, Chicago, Ill.

RAZORS AND BLADES

MILLER'S Safety Razor Sharpening Machine. The most attractive, most durable, easy to operate and fool proof. It sharpens any make of safety razor blade. Yes! It sharpens the blades. Any man or woman can make from $100.00 to $300.00 a month above expenses. Write for Catalog and prices. Sanitary Sharpening Machine Inc., 1905-A Main Street, Kansas City, Mo.

FORTY New Gillette style blades $1. Money back guarantee. Johnson Specialty Co., Box M193, Cleveland, Ohio.

BLADES Resharpened 3c, any make. Guaranteed Service. Standard Safety Razor Corp., Pittsburgh, Pa.

SAFETY Razor Blades, Gillette style, 50 cents dozen. Wm. Wagner, Fargo, N. Dak.

OPTICAL GOODS

BINOCULARS, Binoculars, Binoculars! A glass for every use and every pocketbook. $12 to $60. 4 to 20 power. Guarantee of absolute satisfaction or money back. Get the Geneva price list first. Send for descriptive circular today. Geneva Optical Co., 41 Linden St., Geneva, N. Y.

FOR THE HOME

GRANDFATHER Clock Works, $5.00. Build your own case; Instructions free; make good profits selling your friends. Clock works with chimes for old or new cases. Write for full particulars. Clock Co., Ruffner St., Philadelphia.

LOOMS—Only $9.90 and up. Big money in weaving Colonial Rugs, carpets, etc., from rags and waste material. Weavers are rushed with orders. Send for free Loom Book; it tells all about home weaving and quotes reduced prices and easy terms on our wonderful new looms. Union Loom Works, 480 Factory St., Boonville, N. Y.

CONCRETE Handbook, for the Amateur. We have just published a book describing 173 ways of using concrete in the home, shop and on the farm, with full directions for doing these things yourself with ordinary tools. 138 illustrations. It is "written so you can understand it." Price 50 cents, postpaid. Popular Mechanics Book Dept., 206 E. Ontario St., Chicago.

HOME Mechanics, Attention: We specialize in unusual cabinet hardware and mechanical devices for home furniture construction; copper chest timming, transfer designs, knock down chests, tea wagon wheels, scooter wheels, wood and silk lamp shades, bridge lamp arms and electrical fixtures, cane and reed, porcelain table tops, upholstery supplies, finishing materials, office chair and typewriter desk fixtures, casters, steel rails for wood beds, locks, hinges, catches, dowels, costumer hooks, smoking stand trimmings, etc. Most complete line entire country this class material. Send ten cents stamps for Tenth Annual Catalog "Hard-to-Get" materials. Thurston Manual Training Supply Company, Anoka, Minn.

HOME Mechanics—A new Popular Mechanics Handbook containing 329 discoveries that will be of value to anyone who has a home. 96 pages—203 illustrations. 50 cents. Popular Mechanics Press, Popular Mechanics Building, Room 807, Chicago, Ill.

FOR more heat from less fuel, less work tending the furnace; even, steady heat at all times—attach the Crown Fuel Saver to your furnace. This inexpensive device is guaranteed to make a coal-saving of at least 20% or your money refunded. Write for booklet. C.F.S.CO., 15 N. 10th St., Richmond, Ind.

DIAMONDS, WATCHES AND JEWELRY

CALIFORNIA Abalone Blister Pearls. Pins—rings, Dollar Each. Winona Products Company, 525 West Santa Barbara, Los Angeles.

ANTIQUES, WAR AND INDIAN RELICS

FOR Dens; Relics, collected from Europe's Battlefields, Illustrated Catalogue and sample War Photos 25c. Lieut. Welsh, 2117 Regent Pl., Brooklyn, N. Y.

WANTED—Furniture, clocks, glass, china, lamps, anything old. Wm. Longnecker, 85-E. Genesee St., Buffalo, N. Y.

INDIAN Made Baskets, Blankets, Beads, Curios. Catalog. Gilham, Kelseyville, Calif.

SEND 5c for fine, new list Indian relics, antique firearms. F. E. Ellis, Webster Groves, Mo.

PHONOGRAPHS AND RECORDS

PERFECTION Phonograph-Radio combination tonearms, motors, hardware, highest quality, lowest prices. Free catalog. Federal Supply Company, Indianapolis, Ind.

BUILD your own phonographs. We can supply you with motors, tone arms and all accessories at wholesale prices. Write for catalogue AX. Pleasing Sound Phonograph Co., 264 East 113th St., New York, N. Y.

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AUTO Agency, Garage and Accessory Business—$2,000. Central location, paved street; bldg. worth $3,000; city water, gas, electricity; 5 pleasant living rooms; employs 2 men all year. $2,000 gets it, part cash. Details p. 93, New Illus. Catalog. Free. Strout Farm Agency, 150P Nassau St., New York City.

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WANT to hear from owner having farm for sale; give particulars and lowest price. John J. Black, Chippewa Falls, Wis.

ATTENTION — "Get acquainted." Cash for your property, Farm, Hotel or Retail Store, no matter where located; confidential service. Hayes' Business Agency, Cincinnati, Ohio.

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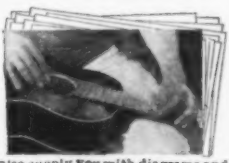

Arthur Brisbane, the highest paid journalist in the world once said that **"A single picture is worth a thousand words."** He was right, for it stands to reason when you take your instrument in hand along with actual photographs of our professors in action as your guide, it is easy to imitate and do the right thing.

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PROOF

Expects to Play by Bed Time

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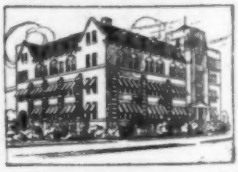

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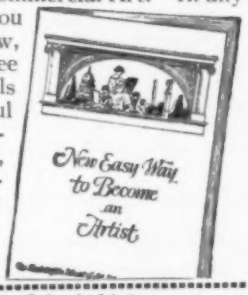

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15,000,000 Cars—A World-Wide, Wonderful Business

Think what opportunities are open in the servicing of over fifteen million cars in the U. S. A. alone. Men who know the business can get a job anywhere in the world.

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J. R. Navarre, Carrollton, Ohio (Service Mgr. of Dodge Station), writes: "Three years ago when I left your school I was nearly broke, and a single man. Now I have a fine job, wonderful wife and comfortable home. Mechanics think I must have had twenty years' experience. M. S. A. S. gave me all I needed."

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Write Me Today Send for the details of our great Master Course (and our other Courses). Use the coupon, or write. I will answer you personally. Every student here gets personal attention and is a Life Member. Write me today.

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Thousands of young men with no previous training or knowledge of music are learning to play trap drums and are making from $75 to $200 a week. You can do the same if you make up your mind to start at once and secure one of these fine outfits with free instruction. Naturally, your selection will be a Ludwig—the choice of 95% of the drummers now playing with the popular bands and dance orchestras. ***Ask any professional.***

Joseph Frank, famous trap drummer with Isham Jones, Brunswick Orchestra, uses and recommends Ludwig Drums

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Trap drums are the easiest of all instruments to play. Less than an hour after you get hold of the sticks, you will be able to play ordinary beats. With a little practice, you will be "jazzing" away in approved fashion. ***Music is not essential***—you don't have to know one note from another. That's why any beginner can play trap drums in a short time.

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Gentlemen: Please send me full information on your Drum Outfits and Free Trial Offer.

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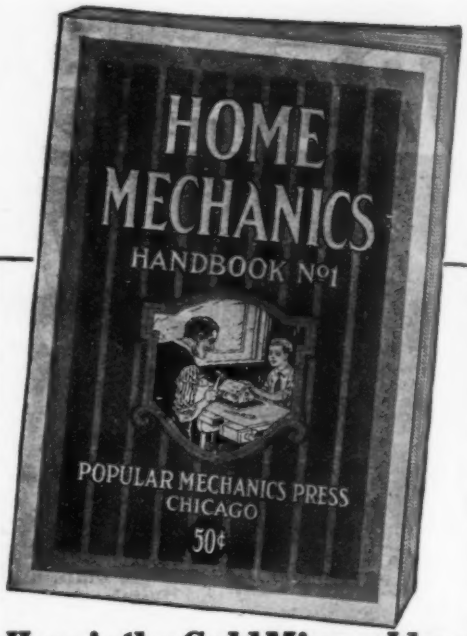

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The pesky furnace fills the house with dust. How can this be avoided? Is there a way to prevent yourself and the house from being littered with soot when you take down the stove? How can you equip your home shop without much expense? How can you make your own equipment for the kitchen? Where can you go to get ideas for electric devices about the house?

These questions and dozens more just as practical are now answered in the Popular Mechanics NEW Home Mechanics Handbook No. 1. Just off the press and crammed with ideas of all sorts for everyone who has a home.

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Every item is a discovery made by someone who encountered an emergency just like you are likely to encounter. The devices are all home-made, and none are patented. Anyone can use them in any way he sees fit. This book is one of the biggest bargains in years, not so much because of its low price as because of its unusual contents. Send for a copy today. Use the attached coupon.

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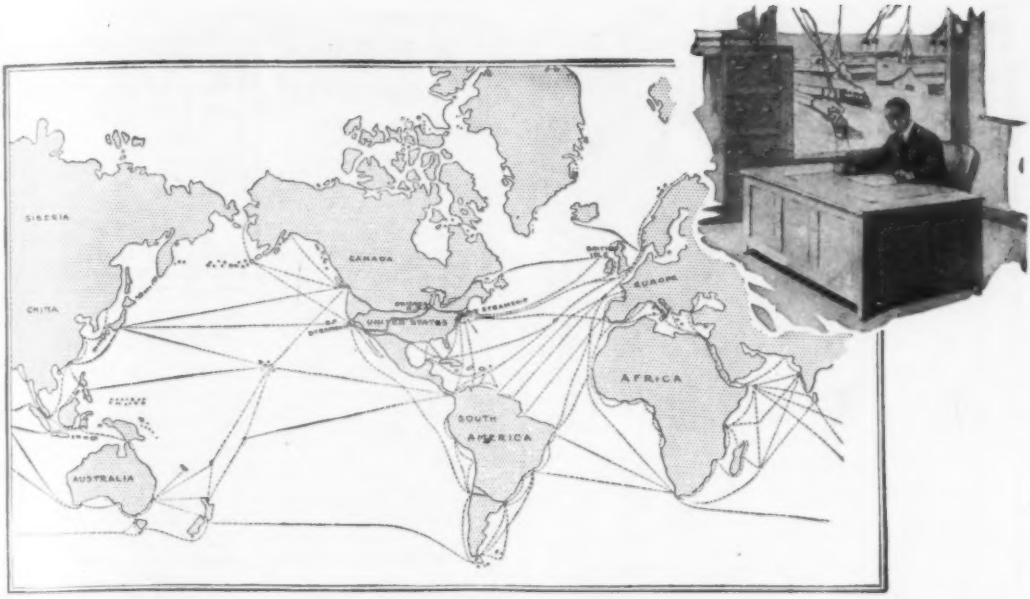

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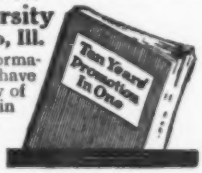

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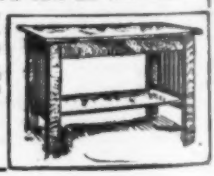

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Earn $50 to $200 a Week in RADIO

You can! Hundreds of ambitious men are already earning thousands of dollars in this wonderful new industry—you, too, can get your share. Mail coupon below for Free Book which describes fully the amazing money-making opportunities in Radio and tells how YOU can earn from $5,000 to over $10,000 a year.

THE astounding growth of Radio has created thousands of big money opportunities. Millions of dollars were spent during the past year on Radio, and thousands of young men are needed right now to meet the ever-increasing demand of work.

Men are needed to build, sell and install Radio sets—to design, test, repair—as radio engineers and executives—as operators at land stations and on ships traveling the world over—as operators at the hundreds of broadcasting stations. And these are just a few of the wonderful opportunities.

Easy to Learn Radio at Home in Spare Time

No matter if you know *nothing* about Radio now, you can quickly become a radio expert, by our marvelous new method of practical instruction—instruction which includes all the material for building the latest up-to-date radio apparatus.

Scores of young men who have taken our course are already earning from $75 to $200 a week. Merle Wetzel of Chicago Heights, Ill., advanced from lineman to Radio Engineer, increasing his salary 100% *even while taking our course!* Emmett Welch, right after finishing his training, started earning $300 a month and expenses. Another graduate is now an operator of a broadcasting station—PWX of Havana, Cuba, and earns $250 a month. Still another graduate, only 16 years, is averaging $70 a week in a radio store.

Wonderful Opportunities

Hardly a week goes by without our receiving urgent calls for our graduates. "We need the services of a competent Radio Engineer." "We want men with executive ability in addition to radio knowledge to become our local managers." "We require the services of several resident demonstrators"—these are just a few small indications of the great variety of opportunities open to our graduates.

Take advantage of our practical training and the unusual conditions in Radio to step into a big paying position in this wonderful new field. Radio offers you more money than you probably ever dreamed possible—fascinating easy work—a chance to travel and see the world if you care to or to take any one of the many radio positions all around you at home. And Radio offers you a glorious future!

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Please send me without the slightest obligation your Free Book, "Rich Rewards in Radio," and full details of your special offer and Free Employment Service. Please write plainly.

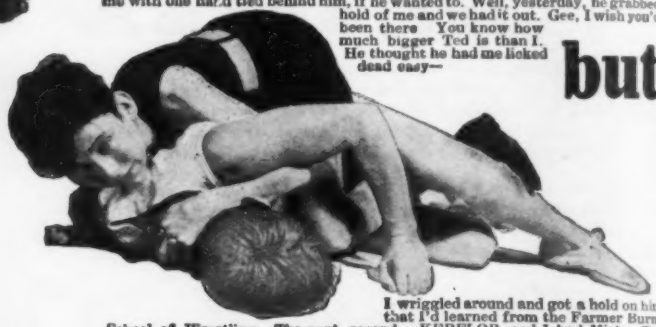
Name.....Age.....

Address.....

City.....State.....

He thought he could throw me—

Dear Tom: You know how Ted Brown has always been saying he could throw me with one hand tied behind him, if he wanted to. Well, yesterday, he grabbed hold of me and we had it out. Gee, I wish you'd been there You know how much bigger Ted is than I. He thought he had me licked dead easy—



but

I wriggled around and got a hold on him that I'd learned from the Farmer Burns School of Wrestling. The next second—KERFLOP, and I had Mister Ted Brown on the ground, yelling for me to quit. It's a cinch to handle a fellow half as big again as you are *if you know the secret holds.* If I were you I'd write to Burns School for their free book about wrestling. So long—FRED.

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Learn the marvelous holds, breaks, blocks and tricks that will enable you to handle big, strong men with ease. The renowned FARMER BURNS—"father of scientific wrestling"—and FRANK GOTCH the world's champion, have prepared a series of lessons in which they reveal the inside secrets of training that will make YOU, too, an expert wrestler. All the great secrets of *self-defense* and *jui-jutsu* illustrated by printed word and picture. The lessons teach you how to become a *great athlete*, and secret knowledge enabling you to throw boys and men larger and stronger than yourself.

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Gentlemen: After graduating from your school in April, 1924, I obtained a position as mechanic with The Auto Service Company, Pompton Lakes, N. J., and am now in partnership with the owner of this Company.
My success in this line of work I feel is entirely due to the very thorough course of training I received at The Stewart Automobile School, and I will highly recommend your course to any one desiring a very complete course in automotive mechanics.

Yours very truly,
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Thousands of men have found the way to success by training at the Stewart Automobile School in New York. They have done it—so can you. Many Stewart graduates own their own businesses or are in executive positions—directing other men. It is so easy, so simple to accomplish, that a man has only himself to blame if he is not on the same road to success within a few weeks.

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YOU yourself are going to set that successful day when you become a factory manager. If you have the courage and ambition to move upward into a bigger salaried job as an expert foreman, superintendent or production manager, nothing can stop you if you are thoroughly trained in the important fundamentals of factory management. Our book,

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Without cost or obligation, please send me a copy of your 48-page CIVIL SERVICE BOOKLET, which tells how I can secure a good-paying position with the U. S. Government.

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Absolutely New—Nothing Like It

The easiest to play wind instrument known. It's a wonder. Anybody—boy or girl, man or woman, can play any jazzy tunes they know the day Jazz-O-Nette arrives. No knowledge of music necessary. Plays like a slide trombone. Plays all flats and sharps in any key.

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This is not a toy but a real wind instrument used by vaudeville actors, entertainers and in orchestra work. Big 10 inch, highly polished, seamless brass horn gives appearance of $50.00 instrument. Amaze your friends at home—play for parties and dances—there's lots of fun and money in it. Be popular everywhere you go. Hundreds of dance orchestras now featuring this jazzy Jazz-O-Nette. Be the first to start it in your town.

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Send only your name and address today. When Jazz-O-Nette arrives, pay the postman our low introductory price, only $6.50 plus a few cents postage. Satisfaction guaranteed. Be the first to play the Jazz-O-Nette—surprise your friends. You can get more real enjoyment out of this than playing piano, banjo, saxophone or other musical instrument. If not satisfied after 3-day trial—you get all your money back. All points outside U. S. send $7.25 with order.

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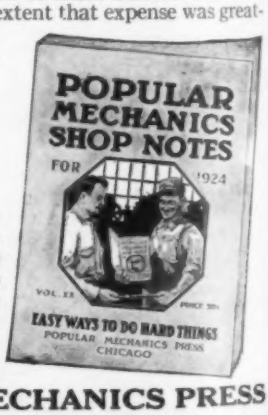

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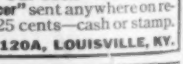

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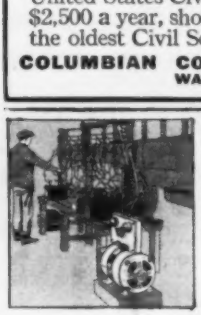

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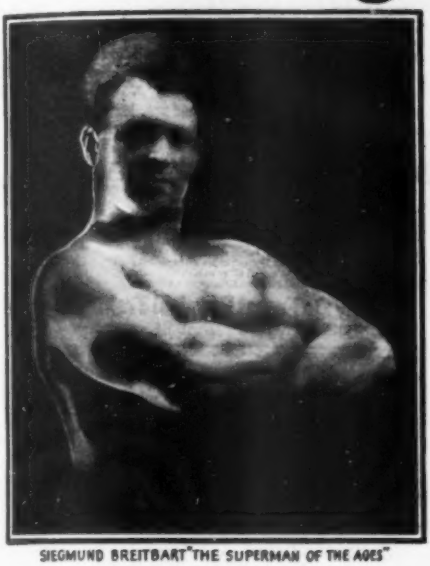

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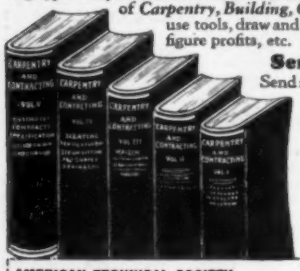

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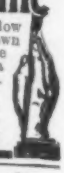

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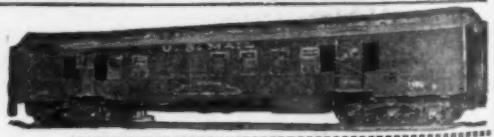

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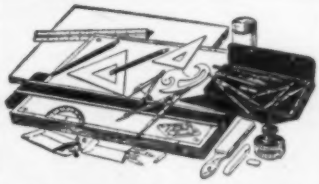

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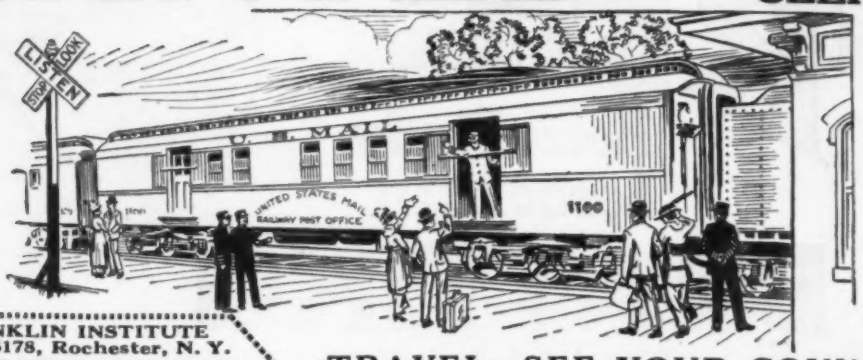

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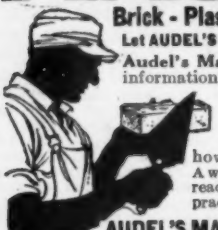

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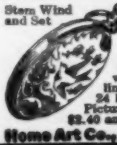

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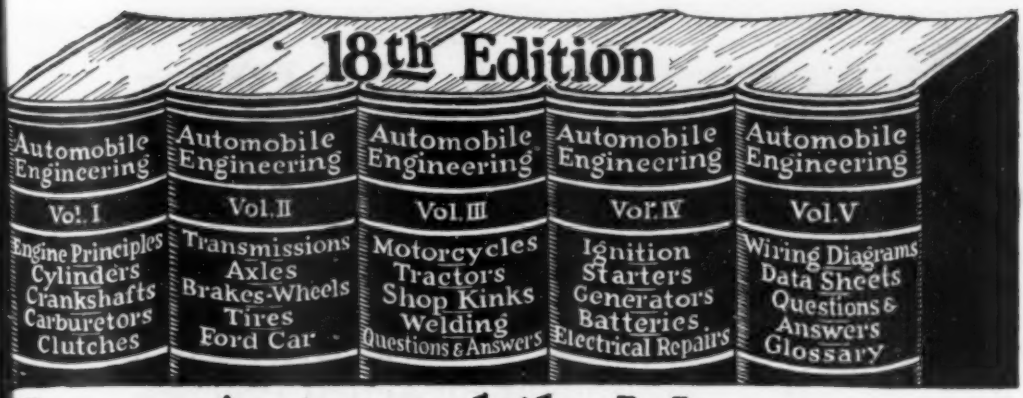

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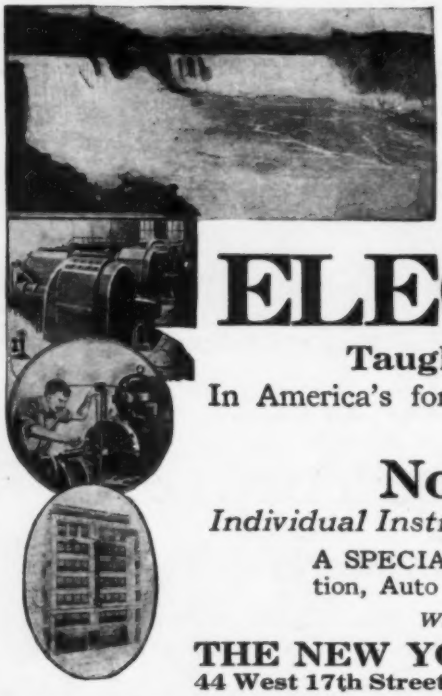

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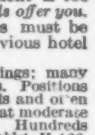

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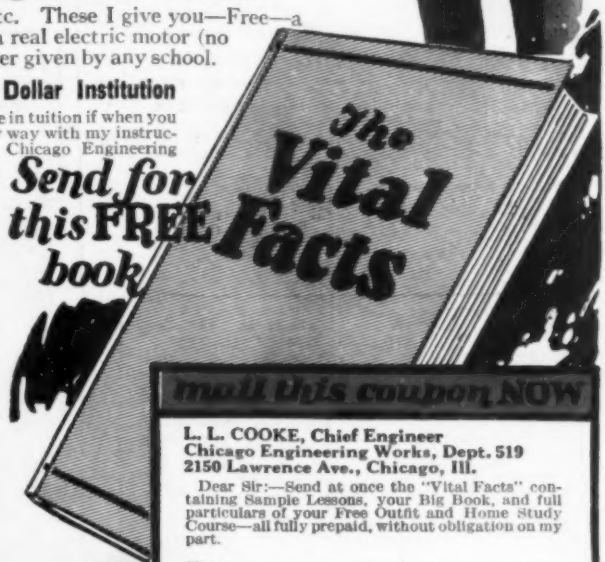

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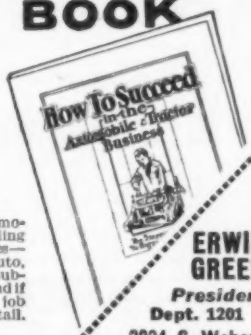

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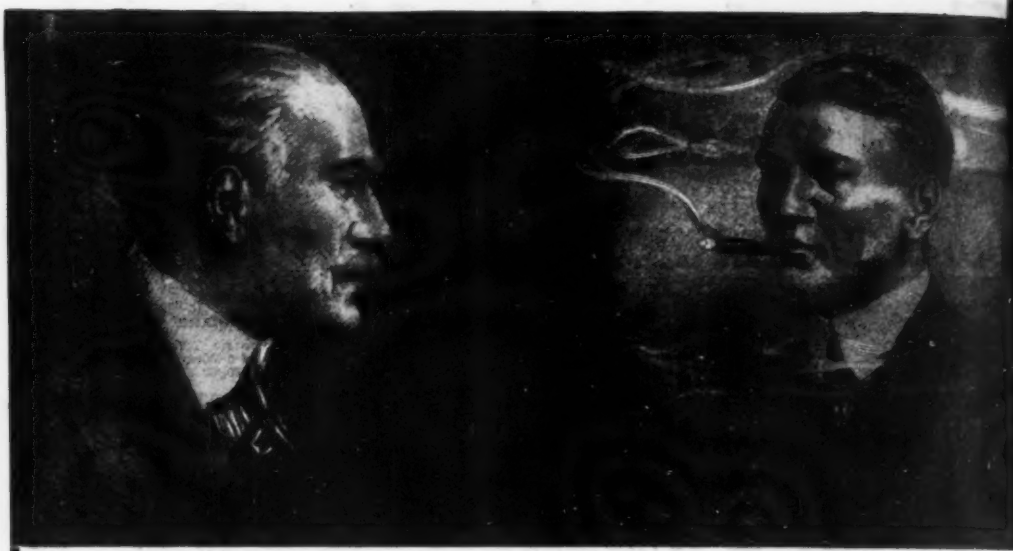

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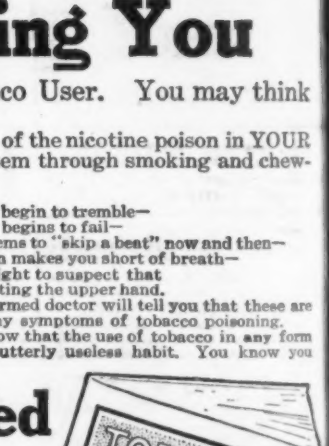

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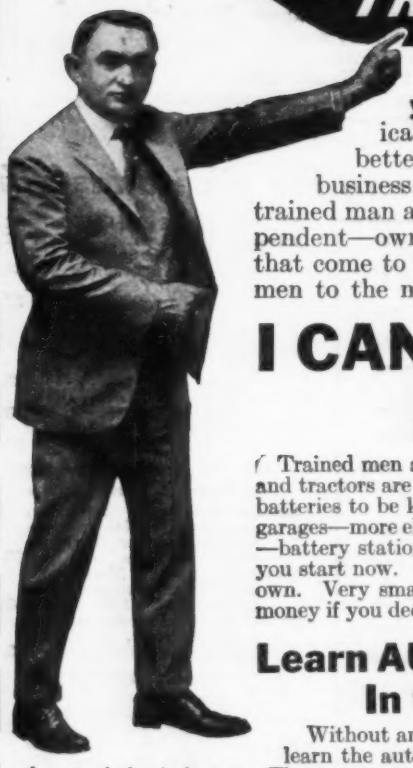

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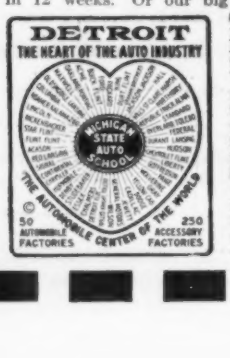

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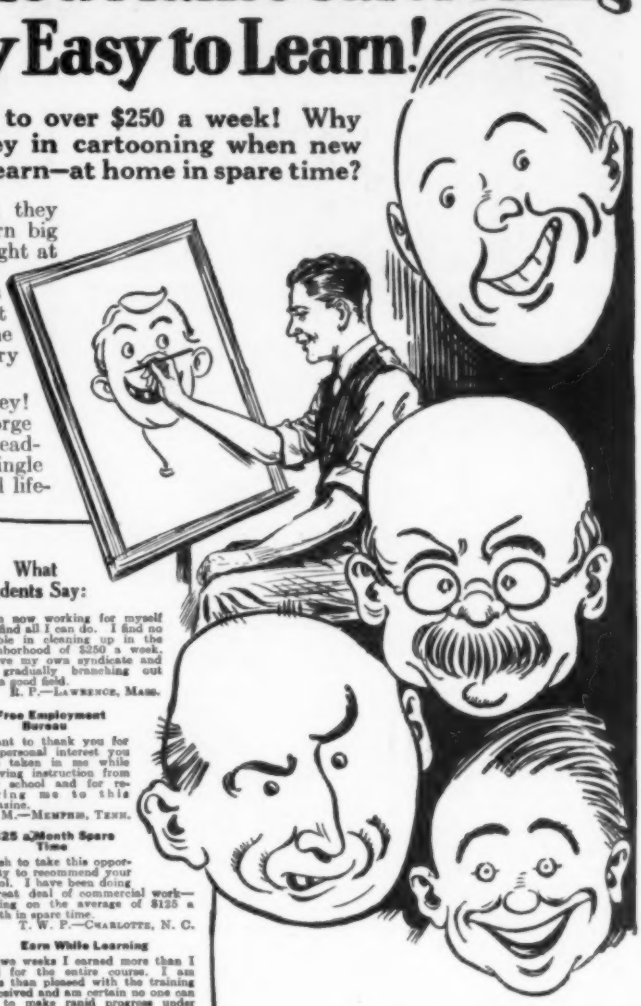

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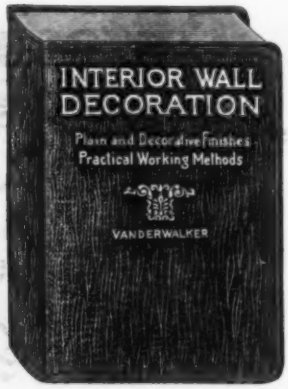

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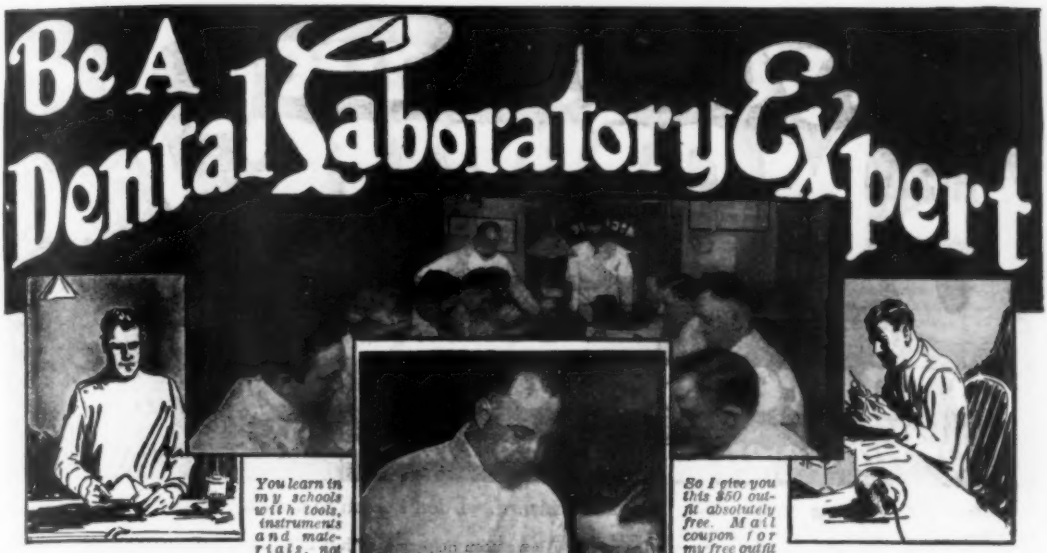

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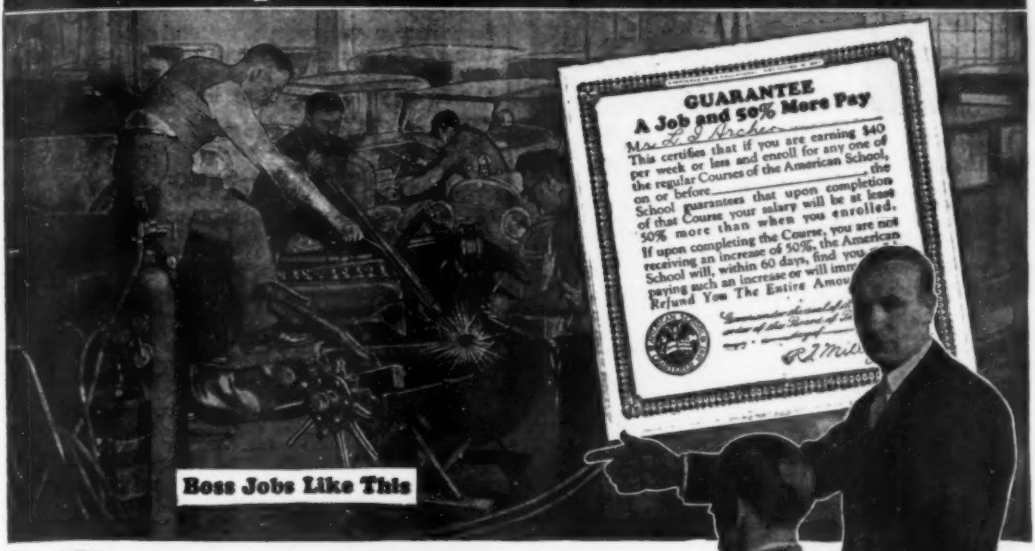

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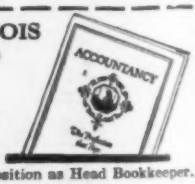

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F. Crossing Gate — No. 2021—**$1.25**

G. Tunnel—No. 86—**$1.50**

H. Improved Transformer—No. 1250—**$3.75**

J. Bridge — No. 213 — **$1.25**

K. Baggage Room — No. 104—**$3.00**

L. Danger — Bell and Light — No. 2016 — **$3.75**

M. Crossing Signal — No. 206—**$0.35**

N. Platform Station—No. 91—**$1.25**

P. Billboard — No. 92 — **$0.35**

R. Fence—No. 216—**$0.60**

S. Trees — No. 214 — Set **$1.25**
Gardens — No. 215 — Set **$1.25**

T. Double Arc Light—No. 2010—**$3.25**

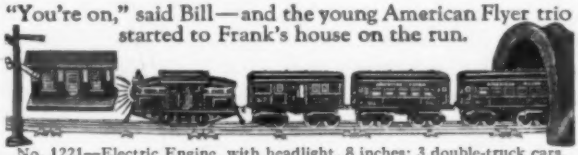
Show this advertisement to your Toy dealer, if he hasn't got the "American Flyer" or Structo Toys and Autos that you want, and doesn't want to order them, we will ship you any Train, Hoisting Toy, Auto or Equipment illustrated, postpaid, on receipt of cash

"WHAT are you going to do this aft?" pipes up Pinkey as the three boys burst out of school on a cold winter day.

"I'm for going into the house and doing something," is little Bill's immediate response.

"Say, you birds I've got it!" suggests Frank, "C'mon over to my house. I've got my "American Flyer" train and a lot of new equipment; a new station, a new semaphore and a bear of a crossing gate. Whadda you say?"

"You're on," said Bill—and the young American Flyer trio started to Frank's house on the run.

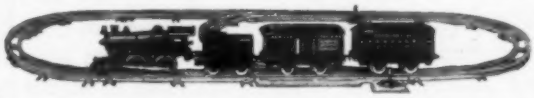


No. 1221—Electric Engine, with headlight, 8 inches; 3 double-truck cars, 6½ inches, 14 pieces of track, semaphore, station, tunnel; rheostat and track connection. Length of train, 31 inches. Price, delivered, $12.00

American Flyer Transformer Price delivered, $3.75

No. 2—Mechanical Engine, with brake and piston rods 6½ inches, tender 4 inches, cars 5½ inches; baggage car has sliding doors; 10 pieces of track; 103 inches; length of train, 24½ inches.

Price, delivered, $2.65



No. 13—Mechanical Engine, with brake and piston rods 7 inches, tender 4 inches, cars 5½ inches, baggage car has sliding doors; 12 pieces of track, 2 switches, length of track, 160 inches, length of train, 25 inches.

Price, delivered, $4.25

Send ten cents and we will mail you Horace Wade's famous story about "The Backyard Railroad" and the beautiful catalogue illustrated in color showing the full line of American Flyer trains and Structo Hoisting Toys and Autos.

STRUCTO Hoisting Toys & Autos

Loads and Dumps Automatically
Height 12¾ Inches
Length 21¼ Inches
Width 6 Inches
Price Delivered $3.75

STRUCTO Giant Steam Shovel No. 110

Model of Real "Cletrac" Type Tractor
Trailer Included—Length Over-all 15 in.
Price Delivered $3.25

STRUCTO "Ready-Built" Caterpillar Tractor No. 44

Loads and Dumps Automatically
Height 12 Inches
Length 13 Inches
Width 4½ Inches
Price Delivered $2.25

STRUCTO Grab Bucket No. 52

Powerful Spring Motor Special Body Raising Attachment
Length Over-all 12 Inches
Price Delivered $2.75

STRUCTO "Ready-Built" Contractor's Truck No. 42

American Flyer Mfg. Co. 2233 So. Halsted St., Chicago

The People's Telephone

The telephone knows no favorites. It does the bidding of the country store and of the city bank. It is found in the ranch house kitchen and in the drawing-room of the city mansion. Its wires penetrate the northern forest, stretch across the prairie, are tunneled under city streets.

The telephone knows no favorites. Its service to all the people is of the same high standard—the Bell System standard. Twenty-four hours a day it carries the voices of all. For the benefit of all, the long-distance circuits are kept in tune. Numberless discoveries and improvements developed by the Bell System have made the telephone more useful for all the people. In America, all can afford the telephone, for Bell System service is the cheapest, as well as the best, in the world.

The telephone knows no favorites. It is not owned in any one locality or by any particular group of men. It is owned by 350,000 stockholders, who represent a cross-section of the thrift of the whole country. The owners of the telephone are those it serves.

In America to-day the 15,000,000 telephones of the Bell System contribute to the security, happiness and efficiency of all the people.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

BELL SYSTEM

One Policy, One System, Universal Service

"Yankee" Radio Tool Set No. 106

Comprises Set No. 105 (see description below) and Drill No. 1431 in mahogany-finished Radio Tool Chest, as illustrated. Packed in handsome holly box.

Price, $8.50

The Ideal Christmas Gift for the Radio Fan

"YANKEE" Radio Tools

WHAT interests men the most about radio? Tinkering, of course! Building new sets; changing hook-ups on old ones; experimenting for better results . . . that's what men enjoy. So the gift of "Yankee" Radio Tools is sure to be appreciated.

"Yankee" Radio Tool Set No. 105. Price, $3.25

Set No. 105 comprises "Yankee" Ratchet Tool Holder (a) with "Yankee" Radio Attachments as follows:

Long Screw-driver Blade (h)—for reaching into box, between wires, etc.
Small Screw-driver Blade (c)—for screws on dials, etc.
Heavy Screw-driver Blade (g)—for putting up aerials, etc.
Countersink (f)—for sinking heads of screws.
Reamer (b)—for enlarging holes in panel.
Wire Bender (j)—for making loops and turns.
Socket Wrenches (d e)—two sizes—to cover all small nuts.
Also, Flat Wrench (i)—for square or hex, one end; other end, hex, for jacks.
Packed in holly box.

"Yankee" Radio Drill No. 1431. Price, $3.00

No. 1431 is a compact, powerful, perfectly balanced hand drill with four to one gear for speed and special radio chuck.
Capacity 9/32 inch. Packed in holly box.

Set No. 105. Price, $3.25
Packed in gift box

"Yankee" Radio Drill No. 1431
Price, $3.00. Packed in gift box

Write for FREE "Yankee" Tool Book

Your hardware dealer can supply "Yankee" Radio Tools

NORTH BROS. MFG. CO., Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

A thoughtful, helpful, useful gift

THE Remington Portable is truly a universal gift—welcomed by people who write, much or little, the world over. It is saving the time of countless women. It is greatly assisting children in their school work, and properly training them for the future. It is indispensable to the college student of today. And men find in the Remington Portable a little helper always ready to lighten every writing task. It is the modern way to write.

The Remington Portable, complete with case, and in a beautiful Christmas container, $60. Easy payment terms if desired. For sale by all Remington branches and over 5000 dealers everywhere. Write for illustrated, "For You—for Everybody." Address Department 12.

REMINGTON TYPEWRITER COMPANY
374 Broadway, New York—*Branches Everywhere*

Remington Portable

THE RECOGNIZED LEADER—IN SALES AND POPULARITY

The Day that Europe Turned to America for Saws

A few Disston favorites

Disston D-8. "The Saw Most Carpenters Use." The most widely used saw in the world.

Disston American Boy Saw. A regular Disston-made saw for your boy. Makes an ideal Christmas gift.

Disston Nest of Saws No. 3. For carpenters and householders. Contains 10" keyhole blade, 14" compass blade, and 16" utility or pruning saw.

Disston Plumber's Nest of Saws No. 60. Same as No. 3 except large blade (18 inches) is metal-cutting saw, for imbedded nails, lead pipe, etc.

OVER at your nearest hardware dealer's there is a saw you will want to see—

For it is the make that brought Europe—and the world—to America for saws!

As though his whole future depended upon it, a young man was smithing a saw. The place was Philadelphia. The year, 1840.

The blows of the smithing hammer on that saw, in the little shop, were the real start of America's saw-making industry.

For while Henry Disston thus smithed his first saw, America was being built with saws made abroad!

The young saw maker worked on. Trying out steels in a furnace made with his own hands. Tempering and smithing blades. Setting, filing and testing saws.

Here a carpenter, there a carpenter, tried the saws with the Disston name. They found

—hang and balance they had never known in any tool;
—temper that gave spring and life;
—clearance that made work easier;
—a cutting edge that held.

They found a saw that *worked* with hand and arm: sawing straight, cutting keenly without dragging, and with never a wobble.

The news spread!

And then came the day of the American-made saw—the day when Europe reached across the Atlantic for Disston Hand Saws.

Henry Disston now made his own steel—America's first crucible saw steel.

And Disston Saws of Disston Steel won the world!

All the while—a greater thing than working with metals, he worked with men: Making saw makers, passing on to them his skill, his ambitions, his tirelessness for excellence.

The little shop became the largest saw works on earth—68 buildings, 3600 craftsmen.

Remember all this, when next you visit your hardware dealer's. Ask to see the Disston Hand Saw, world famous as "The Saw Most Carpenters Use."

Grasp the handle and try the balance. Note taper and finish; filing and set.

Then make that saw your own. Don't stop until you have drawn a line across a board and sent your Disston saw singing along that line—straight and true.

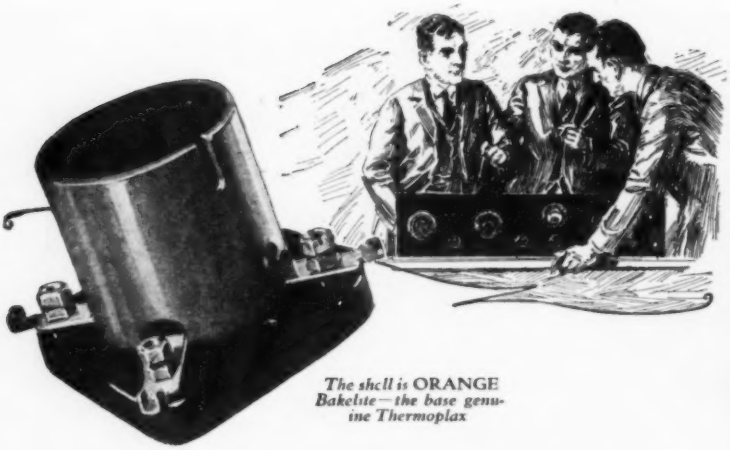
Ask Disston

Tell us what kind of work you are doing, in wood, metal, stone, or other material, and we will tell you what types of saws to use. Disston issues many books to aid the user of saws and tools.

HENRY DISSTON & SONS, Inc.
Philadelphia, U. S. A.

Hardware dealers the world around sell Disston Saws, Tools, and Files

DISSTON



The shell is ORANGE *Bakelite—the base genuine Thermoplax*

The More You Know About Radio the Better You Will Like This Socket

If ever a device were designed to increase the efficiency of all receiving sets, it was this new socket by the Master Builder. Radio Engineers praise it—new set builders marvel at its ease of installation and the clear, loud reception obtained that bespeaks the absence of losses—many old-timers have even rewired their sets to establish new distance records and enjoy clearer reception with this better socket.

You'll like its construction, embodying a minimum of both insulation and metal—capacity absolutely minimized *without sacrifice of mechanical strength.* And its base of ebony Thermoplax in beautiful color contrast with the thin shell of orange Bakelite adds greatly to the appearance of any set as the construction does to its efficiency.

You'll like its contacts (the source of losses and noise in most sockets); they are radically new in design, formed of phosphor bronze and *silver* plated—because the contact resistance of silver does not increase as it stands exposed to air. Then, too, electrical losses are minimized by providing maximum spacing between terminals, both in insulation and in the air.

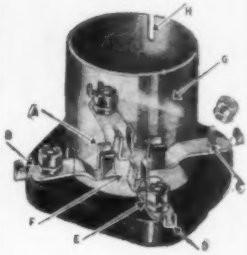
You will like the way the tube is inserted and removed without turning—which prevents twisting the bulb from its base. You will like its appearance—its small size—its neatness. You will like its silvered posts with slotted nuts that are fastened *well* with either screw driver or wrench. You will like the way these terminals are arranged for soldering—extra long so that they may be bent down where under-wiring is desired—and provided with ears to hold the wire in place for soldering. And best of all you will like the price, 90c. *This socket that meets the specifications of the most exacting radio engineer costs no more than most of those on the market today!* If your dealer has not yet been stocked, you can be supplied direct from factory at regular price plus 10c for packing and postage.

THE CUTLER-HAMMER MFG. CO.
Member Radio Section, Associated Manufacturers of Electrical Supplies
Works: MILWAUKEE and NEW YORK

"Built By The Master Builder"

C-H

These Exclusive Features Assure Better Reception



A
Perfect contact. Both sides of tube prong cleaned when inserted—no contact or wear on soldered end.

B
All metal parts *silver* plated—perfect contact for the life of the set. Silver may tarnish but its contact resistance does not change.

C
One piece contact construction. The binding post is NOT a part of the circuit—the wire to the socket always touches the contact strip which carries the current direct to the tube prong—no joints to cause losses.

D
Convenient terminals for soldering—full length to allow bending down for under-wiring. Ears hold wire in place for soldering.

E
Extra handy binding posts—tight connections with either wrench or screw-driver. Lock washers hold terminals rigid.

F
Wide spacing of current carrying parts both in air and insulation—true low-loss construction.

G
A minimum of both metal and insulation for low capacity. Shell of thin Bakelite—the base of genuine Thermoplax.

H
The tube is held in place by merely a vertical motion—no twisting to separate bulb from base.

The attractive orange shell helps identify this better socket, but the famous C-H trade mark both on the socket and on the orange and blue box is your genuine protection.

C-H **RADIO SOCKET**

IMPORTANT BAER BROS. CO. sell all nationally advertised watches and jewelry on credit at established cash prices.

Xmas Gifts on Credit

X27—[illegible] belcher, 14 k. [illegible] gold ring, 7 [illegible] white diamonds set in solid PLATINUM disc. Looks like 2 ct. solitaire **$73.50**

X59—[illegible] carved 18 k. [illegible] white gold onyx ring, blue white diamond. Very stylish and popular **$25**

X99—7 perfectly matched blue white diamonds, set in PLATINUM, 2 sapphires, exquisite new model richly engraved . . . **$95**

X[illegible]—Solid PLATINUM friendship or anniversary ring, 5 perfect cut blue white diamonds, 4 triangular sapphires. Unusually attractive . **$135**

10 Months to Pay

Our Guarantee Absolute Satisfaction or Your Money Back

X45—7 blue [illegible] white diamonds set in PLATINUM, green gold 14 k. engraved ring . . **$52.50**

X54—18 [illegible] white gold ring, hand pierced, perfectly cut blue white diamond. Very popular **$73.50**

X40—Popular 18 k. white gold ring, pierced and engraved, perfect cut blue white diamond. **$50**

X[illegible]—Solid 18 k. white gold ring, perfect cut blue white diamond. **$22.50**

X[illegible]—[illegible]id PLATINUM ring, large perfect cut blue white diamond in top, 4 small diamonds in heart shaped cups on sides. Rarely beautiful. **$125**

FREE

New 1925 DeLuxe Catalog. Thousands of choice gifts in diamonds, watches, pearls, silverware, toilet sets and jewelry. Prices $10 to $1000. **Cash or easy credit terms.** If you do not see what you want in this ad, we suggest that you write today for our FREE CATALOG **before** ordering your Xmas Gifts.

X31—PLATINUM top on 14 k. white gold scarf pin. Blue white diamond, 4 sapphires . . **$25**

X23—18 k. white gold ring neatly and artistically designed perfect cut blue white diamond, two sapphires . . **$75**

X[illegible]—[illegible] blue white perfect cut diamonds, 1 sapphire, 18 k. hand engraved white gold ring. **$50**

X47—[illegible] k. white gold ring, perfect cut blue white diamond, 2 sapphires. Our leader for a low priced ring. **$29.50**

X[illegible]—Engagement ring, 14 k. yellow gold, perfect cut blue white diamond. **$50**

Send No Money

No deposit required. Simply send your name and address and say what article you want. Only if satisfied pay 1-5th (20%) on arrival. Keep it for 10 days' **Free Trial.** Your money back if not satisfied or if you can duplicate these articles anywhere **even for cash.** Otherwise pay balance in 10 equal monthly installments. We make no claims we cannot live up to. **You take no risk.** Transactions strictly confidential. **Guarantee Value Bond with each purchase.** Don't delay—order today. **Address Dept. T-26**

X70—Man's handsome 14 k. green gold ring, 18 k. white gold top, perfect cut blue white diamond. **$87.50**

X[illegible]—[illegible] blue white diamonds, 2 triangular sapphires, 18 k. white gold ring. Very showy . . . **$75**

X[illegible]—18 k. white [illegible] ring, perfect cut blue white diamond, octagon top, pretty design . . . **$25**

X[illegible]—Solid PLATINUM delicately hand engraved ring, perfect cut blue white diamond of first quality. **$87.50**

X52—[illegible], sapphire crown, fancy [illegible], adjusted 19 jewel movement, guaranteed time piece . . . **$23.50**

X49—Engagement ring, 18 k. white gold orange blossom engraving, perfect cut blue white diamond. **$100**

X[illegible]—[illegible] k. white [illegible] seamless wedding ring, 5 perfect cut blue white diamonds, ring engraved all around . **$30**

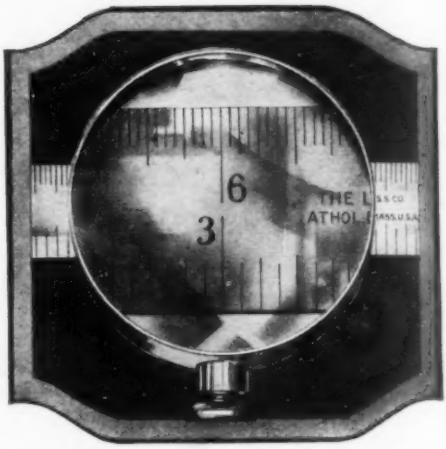
Established 1890

BAER BROS. CO.

Dept. T-26, 6 MAIDEN LANE - NEW YORK

"BILL'S got another new rule, I see. He sure does rust 'em out."

"Not any more—that rule is the same one he's been using for the last two years. It always looks like that—it's a Starrett Stainless."



RUST PROOF

Starrett Stainless Steel Rules laugh at moisture, perspiration and certain acid fumes that soon destroy the usefulness of the ordinary rule. They are made from a fine quality non-rusting, non-staining steel. No. 1000 (hardened and tempered) is made in 6 and 12 inch lengths. No. 1020 (flexible) supplied in 6 inch length only. Like all Starrett Rules, the Stainless is graduated with extreme accuracy—a reading glass proves that even when magnified the division lines show up sharp and clean-cut—perfect in every way. Use Starrett Rules for closer *and easier* work.

7213

THE L. S. STARRETT CO.

World's Greatest Toolmakers—Manufacturers of Hacksaws Unexcelled

ATHOL, MASS.

FREE REFERENCE TABLES

Wire Gauge Standards, Decimal Equivalents, Allowances for Fits, Tap Drill Sizes, Color Chart for use in Tempering, Lubricants for Cutting Tools, Drill Speeds, Double Depth of Threads, Metric Conversion Tables Miscellaneous Measurements, Tables for Computing Weight of Cast Steel.

All this and other valuable information needed by every tool-user will be found in the back of the NEW STARRETT CATALOG. Mailed FREE. Write for No. 23 "AP"

Starrett Tools

Atlas

TRADE MARK

RADIO REPRODUCTION

speaker

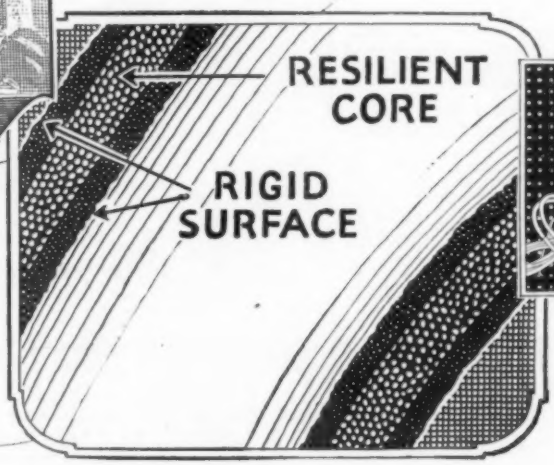
THE material of the horn itself plays an important part in the faithfulness of Atlas Radio Reproduction. The magnified cross-section below shows how the resilient core absorbs the vibrations of the horn material; while the rigid surface conserves the sounds you *ought* to hear —*as* you want to hear them.

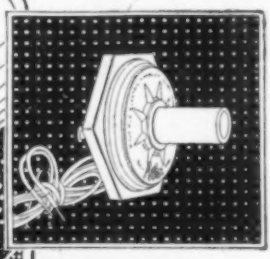
Multiple Electric Products Co., Inc.
36 Spring St., Newark, N. J., Dept. W

New York, Boston, Philadelphia, Baltimore, Pittsburgh, Detroit, Chicago, St. Louis, Denver, 550 Howard Street, San Francisco.

Marconi Wireless Telegraph Co. of Canada, Ltd.
Sole Canadian Distributors

New Atlas speaker with the exclusive and strikingly beautiful bronze-brown ripple-finish.





Atlas unit, complete with attachment couplings, to fit all standard phonographs.

$2 XMAS GIFTS Sent for $2

AZ1 — Lady's hand carved 18K white gold ring set with a perfect cut blue white diamond. $50.

AZ2—Beautiful Fancy design lady's wrist watch; solid 14K white gold fitted with guaranteed movement of 15 ruby and sapphire jewels. $22.

AZ3 — Lady's 18K white gold ring; center set with absolutely perfect, blue white diamond; two flawless diamonds on sides. $100.

AZ4 — Lady's platinum set 7 diamond cluster ring; 20K white gold shank; resembles $750 solitaire. $57.50.

AZ5 — Lady's 18K white gold ring; hexagon center set with perfect cut blue white diamond. $22.

AZ6—Lady's diamond cluster ring; 19K white gold; each side of diamond center is set with a triangular shaped sapphire; looks like $750 solitaire. $67.50.

AZ13 — Platinum Front Scarf pin set with perfect cut blue white diamond. 14K white gold pin. $27.50.

AZ14—Lady's [illegible] gold orange blossom ring set in ¾ Carat size 18K white gold cup with a perfect cut blue white diamond. $75.

AZ7—Lady's lace design ring of 19K white gold; set with perfect cut blue white diamond. $45.

AZ8 — Lady's Elite ring; perfect cut blue white diamond is set in 18K white gold prongs; 14K natural gold shank. $65.

AZ9—Solid platinum lace work design lady's ring set with a perfect cut blue white diamond of first quality. $100.

AZ15—[illegible] wrist watch; 14K [illegible] platinum with 4 perfect cut blue white diamonds; highest grade, 15 jewel movement. Lifetime guarantee. $42.50.

AZ11 — Gentleman's platinum set 7 diamond cluster ring; 18K white gold octagon top; 14K green gold shank; resembles $900 solitaire. $90.

AZ12 — Gentleman's 18K white gold ring; center set with a perfect cut blue white diamond; French blue sapphires on sides. $75.

$2.00 Brings Your Choice

NO RED TAPE—NO DELAY

Simply send $2.00 and your choice goes to you charges paid. You have ten days in which to decide. Money back instantly if you are not satisfied as to the quality and value.

Ten Days' Free Trial

Send only $2.00 and your choice goes to you in handsome gift box all charges paid. Guarantee Bond attesting to quality and value accompanies each shipment.

A Full Year to Pay

Simply send $2.00 and receive your selection, all charges paid. After trial pay balance in 12 monthly payments. 10% discount for Cash.

Free Royal Xmas Catalog

The most complete Catalog ever published of diamonds, Watches, Jewelry, Silverware, Cameras, Ivory Toilet Sets, etc., sent FREE. **Prices from $5.00 to $1000—quality the highest. Ten days' trial and a full year to pay on everything you order from our $2,000,000 stock.** *Send for your copy today. Dept. 1198.*

AZ16—Three perfectly matched blue white diamonds set in 18K white gold top; 18K white or green gold shank. $75.

AZ17 — Lady's genuine Bohemian onyx set with perfect cut blue white diamond; 14K white gold shank. $18.50.

AZ17 — Wedding ring of 18K white gold set with five perfectly matched blue white diamonds. $35.

AZ18 — Lady's 7 diamond platinum set cluster diamond ring; 14K natural gold shank; resembles $600 solitaire. $48.50.

ROYAL DIAMOND & WATCH CO.
170 Broadway - New York

Swings true; cuts fast ...it's a PLUMB

YOU cut true to the line with a Plumb—the hatchet that carpenters choose.

The blade is tapered for fast cutting—shaped and hung just right for easy, slicing strokes.

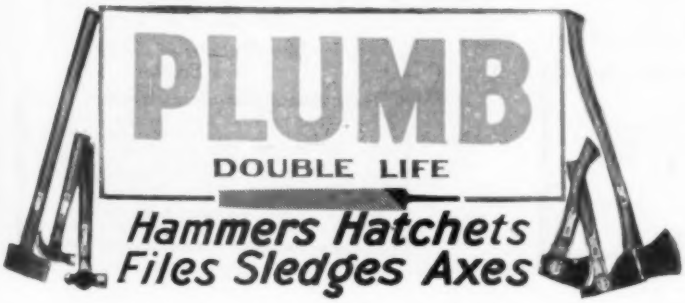
It is forged steel, refined and toughened by armor-plate heat treatment, tempered for long, hard service.

The edge stays sharp; the head stays tight, and you need that in your hatchet!

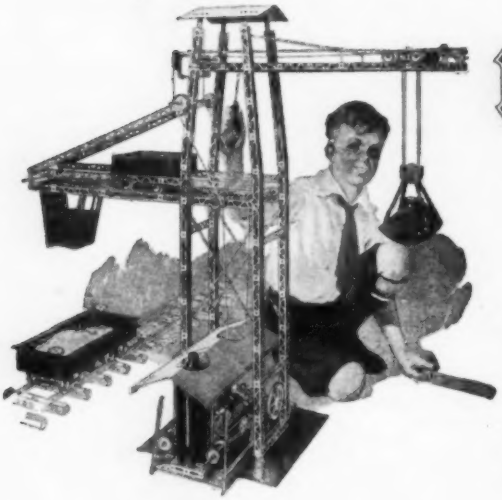
At hardware stores, $1.50 (except in Far West and Canada). "They're worth more."

FAYETTE R. PLUMB, Inc., Philadelphia, U. S. A.

**Red handle and Black Head Color Combination registered as Plumb Trade Mark in U.S. Patent Office*



The greatest thrill you ever had!



THE NEW ERECTOR

"The world's greatest toy"

NEW Erector has many new features this year. Some of them are a steam shovel that digs sand and dumps its contents, a dredge bucket or clam digger; coal loader that unloads a car and loads it in a truck, boilers to make models of steam engines and curved girders to make round models as well as rectangular ones. These parts are all additions to the standard Erector parts known for years, including the sturdy square girder which can only be built with Erector and the powerful Erector electric motor to run models.

"Five Hundred Toys in One"

YOU never saw a construction toy like the New Erector. It is brand-new this year—the latest model with hundreds of new parts. I expect to see some wonderful results this year from the things boys have made with Erector.

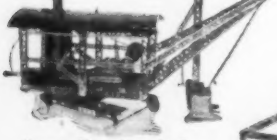
Erector is made of steel with most parts nickel-plated and coated with lacquer baked on by electricity to prevent rusting.

Sit right down now and send the coupon on the bottom of the page so I can tell you about this wonderful New Erector. And don't fail to put the New Gilbert Erector at the head of your Christmas list this year.

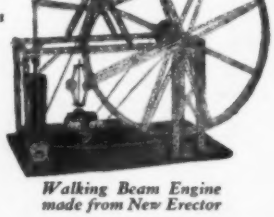
Your friend,

A. C. Gilbert
President.

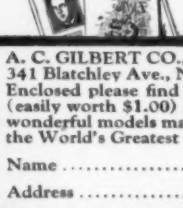
500 TOYS FOR $5 *with powerful electric motor*



Steam Shovel made from New Erector



Walking Beam Engine made from New Erector



A. C. GILBERT CO.,
341 Blatchley Ave., New Haven, Conn.
Enclosed please find 25c for the 146 page Book (easily worth $1.00) describing the hundreds of wonderful models made possible by New Erector, the World's Greatest Construction Toy.

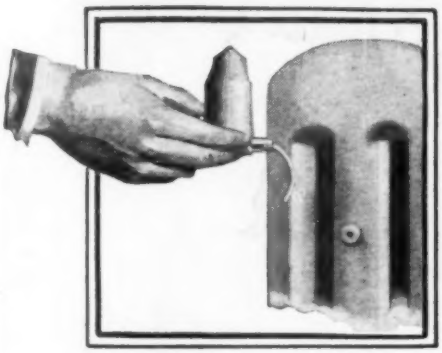
Name .....

Address .....

New Features of the 1924 New Erector

CURVED Girders, Steam Shovel, Dredging Bucket, Steam Boiler, Smoke Stack, Car Trucks, Cab Top, Engine Wheels, Wagon Wheels, Propellers, Reflector, Mitre Gears, Large Gears, Crown Gears, Pulleys, Worm Gears, Drum, Eccentric Cranks, Flanged Wheels, Gear Box, Couplings, Signal Arm, Eccentric Axle, Chain, Large Steel Plates, Turret, Large Base Plates, etc.

New device makes *cold* radiators *hot*



MAKING HOT RADIATORS out of cold ones, is the achievement of an invention called AIRID. The name originates in the operation of this ingenious contrivance which "rids" the radiator of "cold air." AIRID is a perfected air valve which performs its duty under all possible conditions, permitting the steam to push the air out, but preventing the escape of the steam itself.

Despite the mechanical nicety of AIRID, it is so simple that anyone can attach it to any steam radiator without tools in about two minutes. After that, the action is entirely automatic.

Why steam radiators are partly cold

Whenever steam travels through the pipes of a heating system, it pushes air ahead of it.

The radiator is the end of the journey. There the air packs into the radiator, and acts as a barrier against the steam; hence the frequent complaint that the radiator is "half cold." AIRID lets this cold air out; but that's only half the story.

Intelligent *float* knows the difference between air and steam

Inside the AIRID is a metal float, and inside the float is a volatile liquid—the "brains" of the valve. Cold air flows around the float, up through the vent-hole and out. Then steam enters the chamber of the valve, and that is the signal for action. Instantly the liquid inside expands, swelling the sensitive metal bottom of the float enough to raise it from its first position and to thrust a top pin up into the vent-hole. Thus the vent is closed and stays closed as long as the steam is on!

Not even water can escape

Water is present in almost every steam heating system, and AIRID knows how to deal with it, too! The "float" literally floats on the rising water until the opening is closed by the metal pin, as before. The water runs back into the radiator, not out on the floor.

No sputtering or sizzling

Because the AIRID vent shuts absolutely tight, you are spared the misery of sputtering, bubbling and sizzling. This feature, alone, has endeared AIRID to many home owners.

$1.60—little enough for a hot radiator!

AIRID costs only $1.60. The installation can be made without tools in about two minutes. From the moment AIRID begins to work, your radiator is hot—*permanently.*

Send the coupon with $1.60 and prove this to your own satisfaction in your coldest room.

Made and guaranteed by

AMERICAN RADIATOR COMPANY

Sold at all heating and plumbing shops

AIRID

AIR-VALVES

AMERICAN RADIATOR COMPANY
Specialties Dept.
1807 Elmwood Ave.
Buffalo, N.Y.

I am enclosing $1.60 for an AIRID Air Valve to make my coldest radiator *hot.*

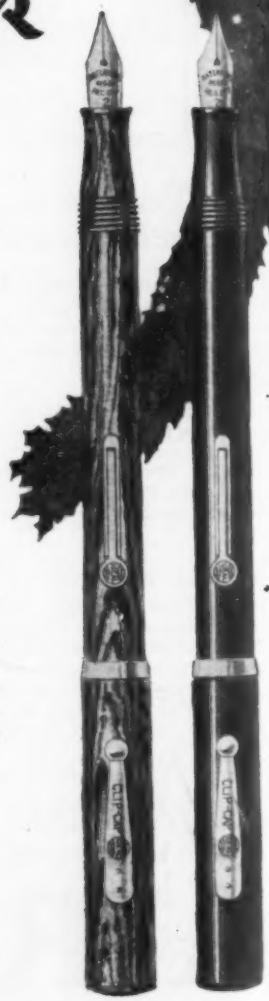
Name.....

Address.....

.....

Say "Merry Christmas" with a Waterman's

Whether you say "Merry Christmas" with a letter or a present, *say it with a Waterman's*—a pen that writes a perfect letter and makes a perfect gift.



Waterman's Ideal Fountain Pen

WHEN you give a Waterman's there is no doubt about the value or acceptability of the gift. For forty years Waterman's has been recognized as the pen of all pens.

DIFFERENT sized holders for different sized hands; different pen points for different styles of writing. May be had from $2.50 to $50, depending upon size and decoration. *Every pen is as perfect as a pen can be made.*

MODELS illustrated are made with our special feature, gold flexible lip-band. Holders red, mottled and black. Sell for $4.00, $5.50 and $6.50, according to size.

ASK your merchant to show you a Waterman's

Look for this show-card and Waterman's pens on display in merchants' windows. 50,000 reliable merchants sell them.

L. E. Waterman Company

191 BROADWAY, NEW YORK

CHICAGO BOSTON SAN FRANCISCO MONTREAL

The 21 Jewel Santa Fe Special

Look sent on approval

Send no Money

We will send this famous watch, express prepaid, for you to examine, to inspect, to admire, to approve, without one penny advance payment. Examine the watch and be convinced it's the best watch buy you ever saw, then just a small payment down, the balance in easy MONTHLY payments. You use the watch while paying for it.

Save 1/3 to 1/2 of Your Money

by purchasing this famous Santa Fe Special Watch. Not only are you saving money from the present day prices of watches, but you can still secure the "Santa Fe Special" Watch at the same low prices and terms that have made our watches famous.

Ladies' Wrist Watches—The New Elite

This Artistic, dependable Ladies' Wrist Watch, fitted with genuine Illinois Springfield movements. A perfect timepiece. Beautiful 14 Karat white or green solid gold cases. Ask for New Watch Book showing cases in all the new shapes and designs. Watch sent on approval and sold on payments.

Send for Free Watch Book

Clip the coupon, fill out and receive the FREE WATCH BOOK. All the newest watch case designs in white or green gold, fancy shapes and thin models are shown. Read our easy payment offer. Wear the watch 30 days FREE. Watch sent for your examination and approval without a penny down. Nothing to risk. See the watch before you buy.

Write for FREE book Today and Select Your Watch—Mail Coupon.

Santa Fe Watch Company,
Dept. C-6, Thomas Building, Topeka, Kans.
The Home of the Great Santa Fe Railway

Ask for our Beautiful Diamond Book FREE. Shows all the new styles in rings and tells about our rock bottom prices and our charge account plan.

A few cents a day makes you own a diamond.

FREE BOOK COUPON

Santa Fe Watch Co.
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Thomas Building,
Topeka, Kansas

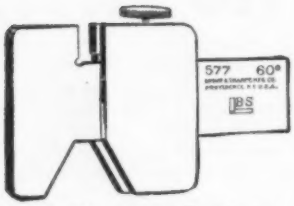
Please send prepaid and without obligation your Watch Book Free, explaining your "No Money Down" Offer on the Santa Fe Special Watch.

Name .....

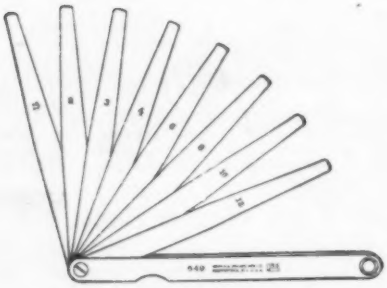
Address .....

State .....

Here's Why I Added These NEW BROWN & SHARPE TOOLS To My Kit



No. 577—Thread Tool Gauge



No. 649—Thickness Gauge

No. 625—Planer and Shaper Gauge

"The Brown & Sharpe Thread Tool Gauge is adjustable and checks any thread cutting tool from a sharp V to a one inch flat within a given angle. It eliminates my keeping a variety of slot gauges on hand for all the different pitches."

"I needed a thickness gauge with long blades and one that I knew was accurate, so I chose a Brown & Sharpe Thickness Gauge No. 649 because the 6" blades are accurately ground to size."

"My Brown & Sharpe Planer and Shaper Gauge No. 625, saves me much time. It is quickly set with a Micrometer, Vernier or Caliper and then the planer cutting tool is accurately set to the gauge."

Learn more about these and other new and useful Brown & Sharpe Tools by sending for a copy of the No. 29 Small Tool Catalog, which is yours for the asking.

Write for a copy today

BROWN & SHARPE MFG. CO.
PROVIDENCE, R. I., U. S. A.

BROWN & SHARPE TOOLS

"Standard of the Mechanical World"

Xmas Gifts on Credit

10 MONTHS TO PAY

Buy your Christmas Gifts on our Easy, Confidential Credit Plan. You pay only one-fifth after you receive and examine your purchase, and the balance in ten equal monthly payments. Thousands of customers have expressed their satisfaction with this easy payment plan.

Sweet Diamonds are noted for their fiery brilliancy, superior AA1 quality, and perfect cut. Everything you buy from Sweet's is absolutely guaranteed to please you or your money will be refunded. Our watches, including every standard make are guaranteed free of repairs for one year. We challenge comparison with the prices of any other concern, either cash or credit.

OUR CHALLENGE

If you do not find that our price on any diamond ring is lower at least 10 per cent than that charged by any other house, either cash or credit, we will gladly refund your payment in full if you return the ring within two weeks.

New Diamond Book *Free*

Our beautiful new Diamond and Gift Book is now ready. It shows a wonderful assortment of gift selections—Diamonds, Watches and Jewelry, Silverware, Ivoryware, Toilet Articles and Novelties. All on Ten Months to pay. Send the Coupon for the Gift Book Today.

X2450 — Sparkling AA1 diamond 14K. Betrothal ring. $77.50.

X2451 — Ladies' engraved 18K. white gold Aquamarine ring, $32.50.

X2452 — PLATINUM SPRED-TOP ring. Fiery, AA1 diamond, $62.50.

X2453—Platinum set 1 diamond cluster ring. 18K. prongs. $57.50.

X2454 — 18K. white gold SPRED-TOP ring. Blue white diamond, $29.50.

X2455 — Gent's 18K. white gold SPRED-TOP. Superior diamond, $92.50.

X[illegible] set 18K. [illegible] Onyx ring, $[illegible]

X2457—PLATINUM top, flexible bracelet with distinctively engraved and pierced design. Set with 3 perfectly cut and matched AA1 quality diamonds and 2 sparkling, blue sapphires, $190.00.

X2458—Hand engraved, 14K. Japanese Diamond signet ring. Artistic nude figure, $[illegible].

X2459—18K. white gold SPRED-TOP ring. Fine quality diamond, $27.50.

X2460 — 14K. diamond set, gents' tooth ring. $67.50.

X2461—[illegible] stamp hand 15 [illegible] crown, silk ribbon, $[illegible].

X2462—24 inch perfectly graduated, silk strung Bluebird Pearls. 18K. clasp set with 2 diamonds and 2 sapphires, $45.00.

L. W. SWEET, Inc.

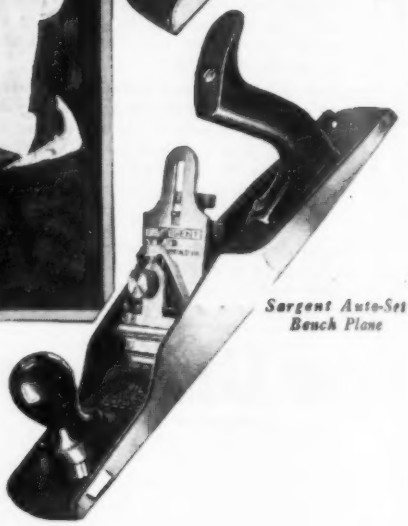
1656 Broadway, Dept. 64-T, New York

Please send me my Free Copy of your new Diamond and Gift Book.

Name.....

Address.....

Sargent Steel Block Plane



Sargent Auto-Set Bench Plane

He'll have it planed in a jiffy!

IN THIS home workshop, radio is king. In fact, a goodly number of big and little sets, comparable to expensive commercial types, have gone from this bench into neighboring homes. This young man has a reputation for good workmanship. He takes particular pride in his ability to choose and use good tools.

Once you have used the handy little Sargent Steel Block Plane no other finishing plane will do. It is great for work in close quarters, for smoothing up panels, bureau drawers that have been sticking, and similar things. It is as true and clean cutting and as finely made as the larger Auto-Set Bench Plane shown above.

The Auto-Set, of course, should be in every workshop for use on the bigger jobs. It is light in weight and remarkably easy to adjust or sharpen. The chromium steel cutter may be removed, honed and replaced without changing the original adjustment. Yet it is so firmly held in place that it never chatters even when cutting across the grain or over rough and knotty surfaces. You will find the Sargent Auto-Set Plane an aid to speed and accuracy.

See these Sargent Planes at your hardware dealer's and write us for interesting booklet.

SARGENT & COMPANY
Hardware Manufacturers

49 Water Street New Haven, Conn.

SARGENT
Tools & Hardware

For a Merry Christmas—for a merry time every day and for many years to come—give your loved ones a Thompson Radio Receiving Set, a Thompson Speaker, or both.

THOMPSON RADIO

Thompson Radio Receiving Sets and Thompson Radio Speakers deliver the highest quality of simplified and economical radio entertainment. Both nearby and distant radio programs cannot be more faithfully reproduced than with a Thompson Radio Receiving Set.

One of the many reasons for the advanced development and perfection in Thompson Radio products is an organization composed of radio engineers who have been making radio apparatus *exclusively* ever since "radio" was called "wireless."

The 5-tube GRANDETTE is $125. The 5-tube PARLOR GRAND, (shown in large picture below) is $145. The 6-tube CONCERT GRAND, is $180. Prices are without tubes or batteries. The Thompson Speaker, with conical diaphragm and other special features, is now $28.

If your dealer does not handle Thompson Radio products, write direct to us for attractive literature and name of dealer near you.

R. E. THOMPSON MANUFACTURING CO.

Manufacturers of Radio Apparatus for the U. S. Army and Navy and many foreign governments

30 CHURCH ST.
NEW YORK, N. Y.
FACTORY:
JERSEY CITY, N. J.

For Handy Man and Mechanic

With this "little sawmill" you can make your own repairs in shop, home, farm or garage. In 1001 ways it will save its cost many times over. Makes a clean edge on the toughest wood—no planing necessary. Rips, crosscuts, bevels, miters, mortises, tenons, or grooves quickly and accurately. Does the work of a skilled mechanic and saves you time, labor and money.

MECHANICS' BENCH SAWS

Can be attached to any lamp socket. Weight only 61 lbs. This saw will cut up to 1¼". Indispensable to wood workers, carpenters, cabinet makers, pattern makers, model makers, inlaid floor makers, hardwood floor finishers, picture framemakers, farmers, printers, radio builders, schools, colleges, homes, etc. All metal. Saw-size 6 inches. Table 10x13, base 7x11, height 7 inches. Table tilts for beveling 5 degrees left, 10 degrees right. Hinged top for cutting grooves, tenons, rabbets. Bearings solid bronze with grease cup lubrication. Guides removable and adjustable rip and cut-off. Sunlight ¼ h. p. motor; 110 volts; 60 cycle; 4.5 amps; 1750 R. P. M. Current A. C. Centrifugal switch with auxiliary finger. High grade steel shaft with ground bearing surface. Water and moisture proof insulating material used throughout. Exterior connections to allow change of direction of rotation. Large grease cups with wick lubrication. Bearings of Bunting phosphor bronze metal.

COMPLETE OUTFIT

$35. **$60 VALUE**

East of the Mississippi. We Pay Delivery Charges. $38 west of the Mississippi. We Pay Delivery Charges.

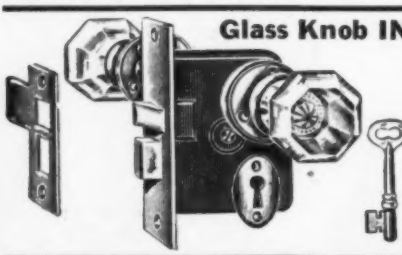
including cord, plug, pulley and belt, everything complete, ready to attach. The saw furnished with this outfit is the Disston 6" Novelty Combination Cross Cut and Rip Saw, guaranteed to run without set. No planing or sanding required after cutting. This saw is equipped with extra heavy duty motor guaranteed to handle 50% overload.

SAW TABLE can be purchased with 6" saw for **$22.50**; We Pay Delivery Charges Anywhere in the U. S. **$22.50**

MOTOR This heavy duty Motor can be furnished separately for **$15.90**; Complete with Cord, Plug, and flat or grooved Pulley. Guaranteed 50% Overload. We Pay Delivery Charges Anywhere in the U. S. **$15.90**

BUILDER'S HARDWARE AT ½ PRICE!

Send us your list for quotations or mail us your plans. We will return them same day as received.



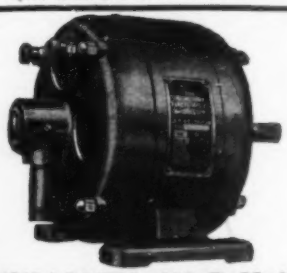
Glass Knob INSIDE LOCK Set

1 Lock, japan case, 3½x3½x9/16 steel plated face.
1 pr. Glass knobs with solid brass roses.
2 Solid brass escutcheons (key plate).

$1.39 PER SET

Parcel Post charges 15c

Per dozen sets $15.95



SUNLIGHT 1/4 H. P. Motor

$12.90 Complete with Cord, Plug and flat or grooved Pulley

Regular Value $30 We Pay Delivery Charges Anywhere in U. S. 110 volts; 60 cycle; 4.5 amps; 1750 R. P. M. Current A. C. Guaranteed to handle 20% overload.

GLASS DOOR KNOBS
Solid Brass Roses
A price never heard of before for a high quality glass knob. P. P. charges 10c. Per dozen pairs, $11.00

98c Pair

CLOSET LATCH SET
With Glass Knob
1 Mortise latch, reversible; 1 Glass knob with brass rose; 1 Inside thumb turn, steel with steel rose. P. P. charges 10c.
Per dozen sets $11.00

98c Per Set

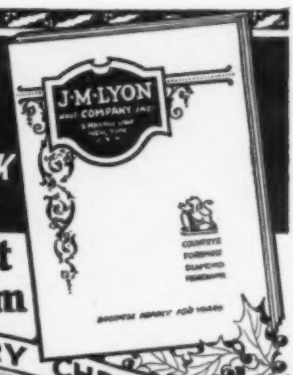
SEND FOR OUR CATALOG

PAUL J. DEVITT, 1101-1107 So. 2nd St., Phila, Pa.

HARDWARE HEADQUARTERS OF PHILADELPHIA

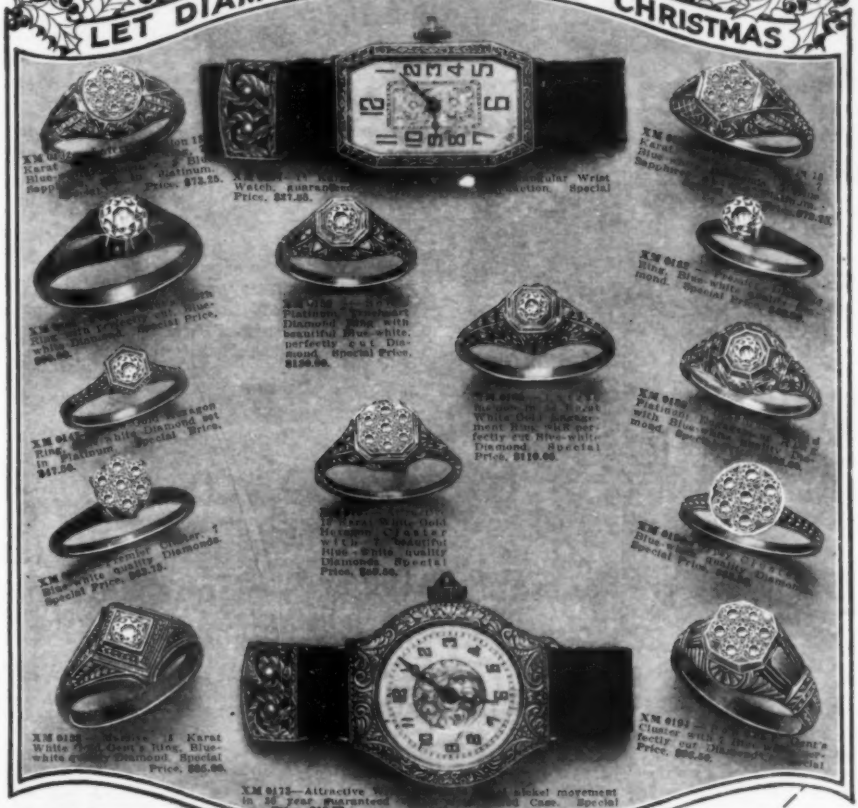
FREE!

THIS MILLION DOLLAR BOOK OF CHRISTMAS BARGAINS



How 8¢ a Day Buys a Gift That Will Never Lose Its Charm

LET DIAMONDS SAY MERRY CHRISTMAS



No Money In Advance

Any of the wonderful Christmas diamond values pictured above sent you for FREE EXAMINATION—not one penny in advance. If you keep your selection, pay at the rate of **Only a Few Cents a Day** Merely the "small change" you now waste on trifles will soon pay for a wonderful diamond. 8% yearly increase in value on all diamond exchanges *absolutely guaranteed.* Also 5% bonus privileges.

Big Million Dollar Bargain Book FREE. Get it now. Make choice from the Greatest Bargains in America. Send coupon for your copy today. Get the benefit of our liberal charge account plan. Write Dept. 1779

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New York, N. Y.

Please send me at once your big 128 page MILLION DOLLAR BARGAIN BOOK, showing thousands of America's Greatest Diamond and Jewelry Bargains.

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Address _____

City _____ State _____

J. M. LYON & CO. INC
2 - 4 MAIDEN LANE, NEW YORK
In Business Nearly 100 years

Artificial lightning was first publicly demonstrated on June 5, 1923, in the laboratory of the General Electric Company at Pittsfield, Mass., when a two-million-volt spark crashed into this miniature village.

What's the use of artificial lightning?

It is mainly experimental, aiding General Electric scientists to solve high power transmission problems. Many such experiments yield no immediate return.

But in the long run this work is practical and important. It is part of the study which must go on unceasingly if this powerful force, Electricity, is to be fully tamed and enlisted in your service.

When the General Electric Company was formed, there was great need of organized electrical research. The Company's laboratories, in Schenectady and elsewhere, have pioneered in increasing the service of electricity and in reducing its cost.

GENERAL ELECTRIC

I'm not a mind reader

but I have a suspicion that someone in your home would like

a Corona for Christmas!

CORONA is such a satisfactory gift! To the novice at typewriting it brings a new and fascinating accomplishment—while the experienced typist finds it the most convenient, practical, sturdy writing machine the world has ever seen.

Talk Corona over with your family today. See if some face (perhaps your own) doesn't light up at the thought of a Corona for Christmas!

Now three models

The new Corona Four with standard office keyboard, $60.

Corona Three, the original Personal Writing Machine, $50.

XC Corona, 90 character machine for foreign language or technical writing, $55.

This is the new CORONA FOUR with standard office keyboard. Look for CORONA in your phone book.

The Service Behind OZARKA Makes This Distance Possible

Pittsburgh, Pa.
Ozarka, Inc.
Chicago, Ill.
Gentlemen:—I want you to know that I think I have received the greatest distance possible on my Ozarka—KGU, Honolulu, Hawaiian Islands.

A great many friends who have radio instruments of all kinds and bought at all kinds of prices, but no one in this city to my knowledge ever received from such a great distance. To say that I am pleased with my instrument is putting it mild.
Yours very truly,
H. J. R.

Alden Bridge, La.
Ozarka Incorporated,
Chicago, Ill.
Gentlemen:—A few nights ago *I heard the beautiful Hawaiian Orchestra, direct from Honolulu*, territory Hawaiian. When you consider the distance that this is from Alden Bridge, I certainly think it ought to be a record. This music came in beautiful and clear, in fact, it could not have been any better.
Yours very truly,
W. H. B.

Nashville, Tenn.
May 14, 1924
Ozarka Inc.
Chicago, Ill.,
Gentlemen:—I consider my best night when I successfully connected in with the following stations: CKAC - Montreal, KGU - Honolulu, WBAP - Fort Worth, WGN - Chicago, WBZ - Springfield, WOAI - San Antonio, KDKA - Pittsburgh, WCAL - Northfield, Minn., WFAA - Dallas, WGY - Schenectady. On a recent night Station KYW - Chicago gave a special program lasting all night.
Yours truly,
O. C.

Why Ozarka Receives from Honolulu

OCCASIONALLY some owner of a radio instrument receives from London, England. But did you ever hear of any one receiving Honolulu, Hawaiian Islands? We will gladly give you the names of the writers of the letters reproduced here, as well as send copies of many letters showing how other Ozarka owners have had results from London, England, Cardiff, Wales and Glasgow, Scotland.

These cases are exceptional, of course, but they must prove to every thinking person that the Ozarka is the greatest distance receiving instrument known today.

In the ownership of an Ozarka Instrument, you are assured of not only the last word in radio, but you will receive expert service, which is far more important than the instrument itself. This is a point you should keep well in mind when you buy radio. Be absolutely sure that the person or firm from whom you purchase is thoroughly capable of keeping that particular instrument in perfect condition. The situation in Radio is exactly the same as that of the automobile. Both are mechanical—both have little things go wrong at times, and both are quickly and easily fixed by the man who knows how.

The Ozarka Radio instrument is sold only by trained factory representatives who know every part, every wire of this instrument. Before he can wear the Ozarka gold button he must satisfy our engineers that he is thoroughly capable of delivering trained service.

More Men Wanted To Sell Ozarka

RADIO offers today an exceptional opportunity for the right kind of a man to build up a permanent, substantial and profitable business of his own. Ozarka factory representatives are today building up very satisfactory incomes for themselves.

In territory which is not now covered there is still an opportunity for a mechanically inclined man who is willing to place himself under our training. We can show such a man how it is possible, to build up a business in his own town, possibly in spare time to start with, but sooner or later will justify giving it all of his time.

We are looking for men who realize that there must be some way of improving their condition. We prefer men who know absolutely nothing about radio, because we can then train them according to our own method.

The man we are looking for has a good reputation, is well and favorably known in his community, may not be a salesman but can talk convincingly on something he knows perfectly and firmly believes in.

The Ozarka Plan will give such a man his first real opportunity to establish himself in a business of his own. Investment of money is small but necessary.

All we must make sure of is that you are determined and willing to put forth the effort. If you will do this just write and say: "Send me your Ozarka Plan Book No. 100." It may be the turning point in your life. Don't fail to mention the name of your county.

This Button identifies Ozarka Representative in your city—your assurance of complete radio satisfaction

4 Tube Ozarka Radio $39.50 and Up

The Ozarka representative will gladly set up this Ozarka instrument in your own home on trial. He will not make any claims but will let you operate it and prove to yourself that it absolutely has no equal for volume, tone, distance and ease of operation. This will not obligate you in any way.

And as for price, you will, no doubt, be agreeably surprised because Ozarka Four Tube Instruments, for loud speaker operation, are sold as low as $39.50.

Let us send you more information about Ozarka, including hundreds of letters giving the most marvelous results ever received on a radio instrument. Drop us a card for our free illustrated book No. 200. Please give name of your county.

OZARKA, Inc., 851 Washington Blvd., CHICAGO

$3 DOWN and it's YOURS

The Greatest Typewriter Bargain Ever Offered

Right now we are making you the greatest typewriter offer you ever dreamed of—an eye opener. This wonderful standard Shipman-Ward Rebuilt Underwood only $3.00 down. Ten days' free trial and the easiest monthly payments, shipped direct to you from our big factory.

10 Days' Free Trial

Yes, only $3.00 down puts this genuine late model Shipman-Ward Rebuilt Underwood in your home. You can try it, test it, and then decide. See for yourself how new it is, how it writes. You must be satisfied. Your $3.00 unconditionally returned if at the end of ten days you are not satisfied. The entire transaction will not cost you one cent.

EASY Monthly Payments

Little more than rental. Balance of payments so small you will hardly notice them, while you enjoy the use of this wonderful machine. You don't have to scrimp and save to pay cash. All at a big saving to you.

5 Year Guarantee

With every typewriter we give a written guarantee. These machines are rebuilt like new by the famous SHIPMAN-WARD PROCESS. Equipped with late improvements. You can't tell them from a new machine. The world's standard typewriter, the same models as sold by the Underwood Typewriter Company today, at a big saving to you. Act now! Get this splendid offer and save money.

From Factory to You

These machines are shipped direct from our factory—the largest typewriter rebuilding plant in the world. They are rebuilt by the famous SHIPMAN-WARD PROCESS. Developed through 30 years in the typewriter business. Through our money saving methods of rebuilding and elimination of a large expensive sales force we are able to make this wonderful money saving offer to you. ACT TODAY, take advantage of it and you will SAVE MONEY.

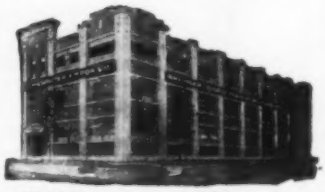
ACT NOW! Mail this coupon today.

Free Book of Facts

Write for this free book of facts explaining Shipman-Ward's wonderful system of rebuilding typewriters. We show you exactly how it's done. How you are able to buy them. Complete and valuable information about the typewriter industry, both instructive and educational.

FREE with Every Typewriter

A complete course in touch typewriting. You don't have to know how to operate a typewriter. You can learn to operate this machine in one day. We also give free a waterproof cover and all tools that come with a typewriter.



All Shipments made direct to you from our modern factory—the largest typewriter rebuilding plant in the world.

FREE BOOK COUPON

SHIPMAN-WARD MFG. CO.
2129 Shipman Bldg.
Montrose and Ravenswood Aves.
CHICAGO

Send by return mail your wonderful offer of Shipman-Ward Standard Rebuilt Underwood, also your book of facts. (This is not an order and does not obligate me in any way.)

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STREET.....

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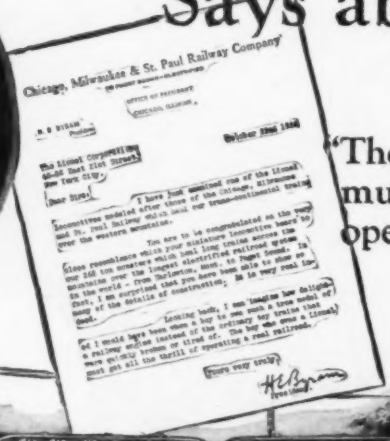
SHIPMAN-WARD MFG. CO.

2129 Shipman Bldg., Montrose and Ravenswood Aves., Chicago

What a Big Railroad Man Says about Lionel

H. E. Byram, President of the Chicago, Milwaukee and St. Paul Railway



Chicago, Milwaukee & St. Paul Railway Company

October 29th 1928

The Lionel Corporation
Wall Street Station
New York City

Dear Sirs:

I have just received one of the Lionel Model Train Sets and our trans-continental train over the western mountains.

Locomotive modeled after those of the Chicago, Milwaukee and St. Paul Railway which haul

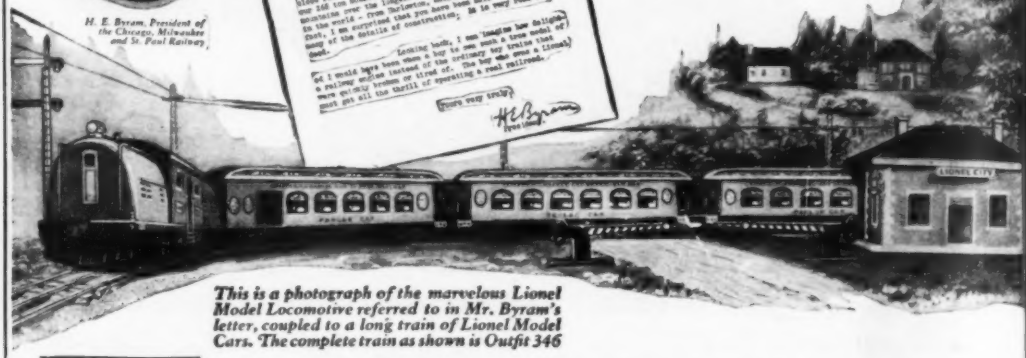
Since receiving this your miniature locomotive seems to me 100 times greater than our 240 ton monsters which haul long trains across the mountains over the longest electrified railroad system in the world - from Harlowton, Mont., to Tacoma, Wash. I am surprised that you have been able to show so many of the details of construction; in a very real sense.

Looking back, I can imagine how delightful it would have been when a boy to own such a true model of a railway engine instead of the ordinary toy trains that were entirely unlike reality. The boy who owns a Lionel must get all the thrill of operating a real railroad.

Yours very truly,

H. E. Byram
President

"The boy who owns a Lionel must get all the thrill of operating a real railroad."



This is a photograph of the marvelous Lionel Model Locomotive referred to in Mr. Byram's letter, coupled to a long train of Lionel Model Cars. The complete train as shown is Outfit 346

Lionel Automatic Train Control — The greatest achievement in model railroad engineering. Starts and stops trains automatically. Just one of the many wonderful realistic railroad devices in the Lionel line of Accessories.

Lionel "Multivolt" Transformers. Ever-reliable power plants. Run all trains best. A type for every size train.

THAT is the statement of a man who knows the latest developments in railroading.

He knows, too, that boys always want trains and equipment that are true to life—that not only *look* like real trains, but *operate* as real trains do.

For 25 years Lionel has specialized in the manufacture of model electric railroads—*not mere "toys"*. Since 1900 Lionel products have been "Standard of the World". Lionel has always pioneered in the development of electric model trains.

The only difference between Lionel and real trains is the size.

Take father with you to see Lionel Trains demonstrated. He will get the same thrill out of them that you do. The power, the beauty, the *realness* of Lionel trains and Accessories is enough to delight anybody.

When a fellow buys a Lionel Model Train, Crossing Gate, Signal Tower, Switch or any of the many other realistic Lionel railroad devices he knows that he has really *got* something of permanent and lasting interest and value.

Complete Lionel "O" Gauge Model Railroads are priced as low as **$5.75** —and a marvelous train for Lionel "Standard" Track, ***with illuminated coaches***, at $16.50. (Prices slightly higher in the Far West.) There are many other complete outfits to suit every purse.

Be sure to see these wonderful trains in your town at department, electric, sporting goods, toy or hardware stores.

Send for Catalog

And don't fail to write for your copy of the wonderful 44-page Lionel Catalog—illustrated throughout in 4 colors. It is free.

The LIONEL CORPORATION
Dept. D 48-52 E. 21st Street NEW YORK CITY

LIONEL ELECTRIC TRAINS

MODEL RAILROAD ACCESSORIES

"MULTIVOLT" TRANSFORMERS

Send For This Sensational Radio Bargain Book-*FREE*

Big Radio Book

Send For it At Once

Order Direct from This Page! Save About One-Half!

Compare our prices with others. Only highest grade nationally known GUARANTEED parts. OUR GUARANTEE PROTECTS YOU. Money cheerfully refunded if you are not satisfied. Be sure to write your order and state prices plainly. Send post office or express money order or bank draft for total amount to insure prompt shipment. ALL PRICES ON THIS PAGE INCLUDE SHIPPING CHARGES RIGHT TO YOUR DOOR. Refer to any bank or commercial agency regarding our reliability. If your favorite circuit is shown here, order direct from this ad. No skill required to build your own radio with Randolph parts. Panels are all drilled. Instructions are simple and complete. Everything comes ready to assemble. Order direct! All shipping charges prepaid.

FREE

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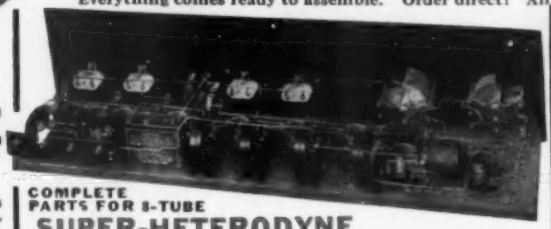
containing a thousand bargains of everything on radio—parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations, and other valuable, up-to-the-minute radio data. Send your name and address on a card or letter. We will send catalog free.

Free Service Department

Our radio engineers will help you solve all your radio problems, and furnish up-to-date information on set construction, operation and improvement. This service is **free** to customers.



COMPLETE PARTS FOR 8-TUBE

SUPER-HETERODYNE

2 23 Plate Bremer-Tully or Duplex Low Loss Condensers.
3 Remler or Columbia Intermediate Frequency Transformers.
1 Remler or Columbia Tuned Circuit Transformer.
1 Special Oscillator Coupler.
1 Midget Condenser.
8 Bakelite Sockets.
2 Thordarson or Columbia A. F. Transformers.
1 Connecticut Filament Switch.
2 Bakelite 6-ohm Rheostats.
2 Bakelite 30-ohm.
1 Bakelite Terminal Strip for Binding Posts.
1 Multicolucord cable for connecting batteries.
2 4" Bakelite Dials.
1 Bakelite Potentiometer 400-ohms.
1 Carter Double Circuit Jack.
1 Dubilier 1 mfd. Condenser.
1 .006 Mica Condenser.
1 .0005 Mica Condenser and 2 megohm grid leak.
3 .00025 Mica Condensers.
1 .00025 Mica Condenser.
9 Binding Posts.
2 4½ Volt C Batteries.
1 7 x 30 x 3-16 Drilled Bakelite Panel. 1 Baseboard.
35 ft. Hook-up Wire.
Complete wiring diagram, baseboard layout and blue-print.

$59.75

Our Guarantee

Every article exactly as represented. Every article is tested before shipping. Complete satisfaction guaranteed or money will be cheerfully refunded.

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23-plate plain Condenser $1.29
23-plate Vernier Condens'r 2.59

RHEOSTATS and POTENTIOMETERS
Bakelite Rheostat, 6-ohm. .38
Bakelite Rheostat, 30-ohm. .59
Bakelite Vernier Rheostat 1.15
Bakelite Potentiometer, 200-ohm. .59

TRANSFORMERS
Randolph Special, 6 to 1, 2.16; 3½ to 1 1.89
Sinclair Special, 6 to 1, 2.55; 3½ to 1 2.24

TUBE SOCKETS and DIALS
4" Hygrade Dial .29
Bakelite Socket .28
Weston Plug .75

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Moulded Variometer 2.39
Bakelite moulded 3.45

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Randolph Special, 2200-ohms 2.45
Blue Bird Special 3.95

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American Bell 3.95
With adjustable loud speaker unit 6.95

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180° Variocouplers .95
Reinartz Coils 1.25
Electric Soldering Iron .98
Cockaday Coil 1.65
Three-Circuit Tuner 2.95

COMPLETE PARTS FOR 5-TUBE

NEUTRODYNE RECEIVING SET

Genuine Hazeltine Licensed Neutrodyne Parts Furnished

PARTS FOR 5-TUBE SET:

1 7x24x1/8 Drilled Panel.
2 Thordarson or Columbia Audio Transformers.
3 4" Bakelite Dials.
2 Precision Jacks.
1 Bakelite Rheostat—30-ohm.
1 Bakelite Rheostat—6-ohm.
1 Bakelite Binding Post Strip.
7 Marked Binding Posts.
1 Grid Leak and Condenser.
9 Bakelite Sockets.
1 .001 Condenser.
1 .006 Mica Condenser.
35 feet Hook-up Wire.
1 Kit consisting of 3 Hazeltine Licensed Neutroformers and 2 Neutrodons.
1 Baseboard.
2 Bezels.
Complete blue-prints working diagrams and instructions.

$33.75

COMPLETE PARTS FOR THE

Improved Four Circuit Tuner

as designed by **L. M. Cockaday**

$39.65

COMPLETE PARTS FOR 3-TUBE

COCKADAY RECEIVING SET

1 Cockaday Coil.
2 23-Plate Hy-Grade Cond.
2 Bakelite Rheostats, 30-ohm.
1 Bakelite Rheostat, 6-ohm.
3 Bakelite Sockets.
1 high ratio Columbia or Thordarson Transformer.
1 Single Circuit Jack.
1 low ratio Columbia or Thordarson Transformer.
2 Double Circuit Jacks.
2 4" Bakelite Dials.
2 Grid Leak and Mica Cond.
7 Switch Points, 2 stops.
1 Bakelite Binding Post Strip.
7 Binding Posts.
1 Switch Lever.
24 ft. Hook-up Wire.
1 7x21x1/8" Drilled Bakelite Panel.
3 Bezels.
1 Baseboard.
Complete blue-prints and wiring diagrams.
1-Tube Set $10.45

3-TUBE SET $19.95

Complete Parts for 2-Tube Harkness Set

7x14 Drilled Bakelite Panel, 2 Harkness Reflex Transformers with Condensers, 2 Dials, 2 Bakelite Sockets, 2 American Bell Transformers, 1 Single Circuit Jack, 1 R. W. Crystal Detector, 1 Bakelite Rheostat 6 ohm, 7 Binding Posts, Baseboard and Busbar Wire, Blue-print to complete wiring..... **$17.95**

Acme 1 Tube Reflex set $17.45
Acme 4 Tube Reflex set $39.85

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159 N. Union Ave. Dept. 246 Chicago, Illinois

"Follow us, if you can!"

THEY all take your dust when you open the throttle of the new "Stream-Line" Harley-Davidson!

Everywhere, sportsmen are talking about this 1925 model of the world's greatest motorcycle. Its rakish, stream-line design makes it the classiest mount on the road. It has more speed —more power. It is more comfortable (better springs and bigger tires). *Yet the price is reduced!*

Treat yourself to the thrill of a trial ride on the new "Stream-Line" Harley-Davidson. Test the speed, power, and vibrationless comfort of this marvelous motorcycle. But look out for "speed cops"—most of them have Harley-Davidsons too!

Ask your dealer for a free demonstration ride and his Pay-as-You-Ride plan. Send us the coupon (below) today.

Harley-Davidson
The Motorcycle

For a Wonderful Christmas!
A handsome, glistening Harley-Davidson "Stream-Line" for Christmas—and for service and sport the year 'round!

Money-making sales opportunity in open territory. Write for particulars.

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Send me free literature showing new "Stream-Line" Harley-Davidsons in actual colors.

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200 Years Ago in the little Saxon town of Schoeneck lived Hans Adam Wurlitzer, Master Violin Maker. His shop was a gathering place for musicians of the time, for he was a true craftsman—the artisan upon whose work the genius of the artist must depend.

When he died his shop passed into the hands of his eldest son, and for seven generations, down to the present day, the descendants of Hans Adam Wurlitzer have carried on his work. Each succeeding generation has added a wider experience as new instruments have been developed, and a greater technical skill as methods of instrument building have been improved.

In every Wurlitzer instrument you will find a quality, a character, that could not come from mere excellence of manufacture. It is the heritage of these seven generations of music-craftsmanship.

Try *Any Wurlitzer Instrument* in Your Own Home

YOU may now have any Wurlitzer instrument for a week's free trial in your own home. Examine the instrument, show it to your friends, play it as much as you wish. No obligation to buy—no expense for the trial. We make this liberal offer because we want you to see for yourself the superior quality of Wurlitzer instruments, the result of 200 years' experience in musical instrument building.

Leading professionals everywhere recognize the artistic quality of Wurlitzer instruments. Ysaye, the great virtuoso; Salvi, internationally famous as a harpist; Carl Preble of Sousa's band; Justin Huber, leader of the well-known syncopated orchestra of that name—artists of the highest standing in every sphere of music use Wurlitzer instruments and recommend them to others. They speak especially of the ease of playing, a feature that is of importance to the amateur as well as the professional.

Easy Payments

If you decide to buy after the week's free trial, payments are arranged in small monthly sums. A few cents a day will pay for your instrument. By buying direct you obtain genuine Wurlitzer quality at moderate prices. Special offers on complete outfits—velvet lined case, all accessories, self-instructor, etc.—all you need at practically the cost of the instrument alone.

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The greatest musical catalog ever published! Over 3,000 articles—every known instrument described and illustrated; many of them shown in full colors. Gives you lowest prices and all details of Free Trial, Easy Payment plan. All sent FREE—no obligation. Send the coupon today.

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Send me, absolutely free, your new illustrated catalog, with prices and description of every known musical instrument. Also tell me how I may try any instrument in my own home and pay for it in small monthly sums. No obligation.

Name _____

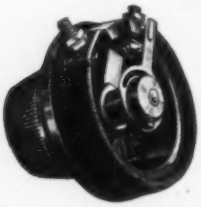
Address _____

City _____ *State* _____

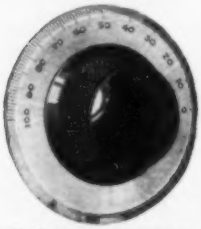
Instrument _____
(*State instrument in which you are interested*)

Copyright, 1924, The Rudolph Wurlitzer Co.

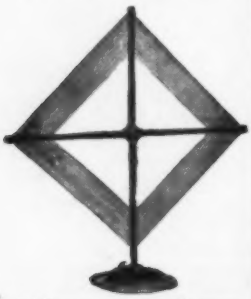
Exclusive features give Erla Miniloss Condensers highest efficiency. Dielectric and resistance losses absolutely minimized. Compensating plate form. 5 to 41 plates, priced $3.50 to $5.50 each.



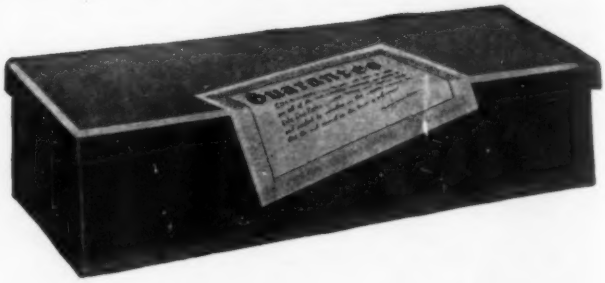
Uncanny smoothness and sensitiveness bespeak the advanced design of Erla Precision Rheostats. Single hole mounting eliminates need for disassembly. 6, 25, or 40 ohm. Price, $1.10 each.



Built for permanent true running; with Bakelite knob shaped for sensitive touch; and highly artistic calibration, Erla dials better any panel. Three sizes for ¼" shaft. Price, 50c to $1.25.



Adding to receiver efficiency is the advanced Erla Loop. Rigidly erected—compactly folded—easy in rotation—beautifully finished. Standard and De Luxe models, $7.50 and $10 respectively.



CIR-KIT builds new Supereflex—Greatest of Erla Circuits

Erla led the radio amateur out of the wilderness of circuits. Erla initially introduced exclusive circuit ideas which made radio history, particularly because those ideas have uninterruptedly kept Erla circuits in advance of contemporary radio.

Remarkably significant is the fact that so many thousands of seasoned experimenters, once attracted to Erla circuits, consistently adhere to Erla. So there is a note of finality when Erla now announces the new Erla Supereflex Circuits. They represent highest development of the inherently superior Erla principles, acknowledged responsible for the most powerful circuits ever built, tube for tube.

Bringing these latest and finest circuits within the reach of everyone is the Erla *CIR-KIT*, effecting not only extreme economy, but also greatest ease of construction. Only screwdriver and pliers are needed to transform any Erla *CIR-KIT* quickly and skillfully into the most efficient of radio receivers.

CIR-KIT provides you with *everything*, including specially designed Erla Synchronizing Transformers, Erla Certified Capacity Condensers, Erla Cushion Sockets, and finally Erla famous Solderless Connectors, banishing all solder difficulties. Each unit and connection is unerringly located through full-size blue-prints; drilled, lettered panel; and stenciled baseboard.

With Erla *CIR-KIT* you yourself can confidently and proudly put into finished form the highest achievement of Erla radio engineers—Erla Supereflex Circuits. *CIR-KIT* receivers of one to five tubes are available, in loop and antenna types. See the Erla dealer, or write direct, mentioning your dealer.

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This is your opportunity to actually use this Royal 10 Typewriter for ten days without obligation to buy. Compare it and its work with all other typewriters. You will readily see why hundreds of thousands of typewriter users prefer the Royal. Simply fill in the coupon and mail at once. We will send the Royal for ten days' trial without obligation to buy. You must be entirely satisfied in every way that this is the greatest typewriter bargain ever offered.

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Think of it! Securing this latest model Royal 10 fully guaranteed, with all latest improvements for about half the original factory price. Simply send us $3.00 with the coupon and we will send the Royal for ten days' trial without obligation to buy. After trial, and when entirely satisfied send us only $5.00 per month until our low direct-from-factory price, $58.00, has been paid and the machine is then yours. We give you the same guarantee as if you paid the original factory price.

Net cash price only $52.20 Direct from our factory to you.

Act Now

There are only a limited number of these Royal Typewriters at our low direct-from-factory price. So rush your order NOW.

Young Process Re-Manufactured

The famous "Young Process" means a mechanically perfect operating typewriter, guaranteed like new. Every typewriter is completely torn down, cleaned thoroughly by our special process; hand-brush enameled, baked in our special ovens; highest quality nickel-plated; all worn, weak or faulty parts replaced with new parts, entire machine completely assembled, adjusted and perfectly aligned by specialized typewriter experts.

You cannot tell the "Young Process Re-Manufactured" Royal from a brand new typewriter in appearance, service and workmanship. Comes to you guaranteed for five years at about half original factory price.

Young Typewriter Co.
654 W. Randolph, Dept. 210C, Chicago

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654 W. Randolph St., Chicago, Ill.

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Name .....

Street Address .....

City ..... *State* .....

Without this tree modern athletics would be impossible

WHETHER it's tennis or basketball—football or baseball—nearly all sports depend to some extent on the product of one tree!

That is the rubber tree.

Without rubber many games would have to be played quite differently—or not at all.

Rubber is made from latex—a milky-white fluid—that oozes from the bark of the rubber tree. Rubber trees are now grown in well-tended plantations. The largest rubber orchard in the world is owned by the makers of Keds. In it is produced today some of the finest rubber known.

It's this rubber that gives to the Keds sole a lightness and spring that ordinary rubber can never impart. It explains why Keds soles are so tough and wear so long.

Keds vary in price according to grade, size and style—from $1.25 to $4.50.

It is important to remember that Keds are made only by the United States Rubber Company. And every Keds shoe has the name Keds on it. No other shoe can give real Keds service.

The Keds Hand-book for Boys is full of things every boy will want to know about—how to make things, rules for games, woodcraft, etc. Sent free if you address Dept. 736, 1790 Broadway, New York City.

United States Rubber Company

A sturdy athletic-trim Keds model—popular everywhere

Keds

Trademark Reg. U. S. Pat. Off.

They are not Keds unless the name Keds is on the shoe

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140-page Book full of life-size ruled forms, each one completely filled in. The answer to problems of accounting and record keeping for any business or profession.

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Ford Touring Top and Back Curtain

32 oz., $5.25; 36 oz., $6.25; Side Curtains, $5.95; Door-Opening type, $6.95; Back Curtain, regular, $2; Gypsy type, $4. Ford One-Man Top, fits 1915 to 1922 model, all new bows and side curtains, $25. Chevrolet, Dodge, Overland 4 tops, 34 oz., $9.75; double texture, $12.25. 6x18 glass Gypsy Curtain extra, $2. Tacks, etc., furnished ready to put on. Delivered 1000 miles.

Vanderpool's Top Factory, Dept. 12P, Springfield, Ohio

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Mount Birds

We teach you **by mail** to stuff and mount all kinds of **Birds, Animals, Game Heads.** Also to tan skins and make rugs. Be your own taxidermist. Decorate your home with your beautiful trophies or increase your income selling specimens and mounting for others. Easily, quickly learned in spare time by men and women. Highest endorsements by thousands of students. Write today for our great free book **"How to Mount Birds and Animals" Free**—write today.

N. W. School of Taxidermy 1779 Elwood Bldg., Omaha, Neb.

Diamonds Here at 60% of Market Price

Free Bulletin lists diamonds as low as $60 per carat, also **Gems of Finest Quality** at higher per carat charges, but proportionately **Low Bargain Prices.** This 3/4 less 1-16 carat correctly cut diamond, a snappy blazing solitaire at $68.50. *This 78 year oldest largest Diamond Banking Firm in all the world* lends money on diamonds. Thousands of unpaid loans and other bargains. Many from big cash deals direct with European Diamond Cutters. Must sell NOW.

WHY PAY FULL PRICES

Costs Nothing to See

Any Diamond sent for absolutely free examination at our risk. No obligation. No cost to you. **Latest Listings—Unpaid Loans. Sent Free.** Describes Diamond Bargains in Detail, gives cash loan values guaranteed. Explains unlimited exchange privilege. **Write Today for your copy of Diamond Bargain List.** Postal card will do.

$68.50 3/4-1/16 Carat Correctly Cut

Jos. De Roy & Sons, *Only Opposite Post Office* **1927 De Roy Building Pittsburgh, Pa.**

A Wise Old Trapper

In the state of Ohio there lived a bunch of boys who had this trapping business down to a science. They each sent for separate price lists every year and then sent all their furs to the house giving the best quotations. After five years they decided they weren't so dreadfully wise because they didn't have enough profits to make their efforts worth while.

One day they met Tom McMillan driving a new car to town. Tom said he made the price of his swell outfit shipping pelts. He told how he got wise to those funny prices and found it was better to deal with Chas. Porter because he always knew in advance just what he was sure of getting. He said that Porter never offered $5 for a $3 pelt but he always paid the $3 which he promised and sometimes a little better. Chas. Porter now has five wise trappers in that section instead of one.

Don't Take a Chance With Your FURS

Send us your name and address. Get our Price Bulletins, Shipping Tags, and full particulars. Do it right now. This means real dollars to you, so don't put it off. Write today.

Your furs mean real dollars to you. Why sell them to some fellow who offers you $1.25 when you know blame well you are lucky to get fifty cents. Ask the wise trapper who knows. Once a Chas. Porter shipper and you will always be one. You know in advance that we give a square deal and every shipment brings sure money.

CHARLES S. PORTER, INC.
123 West 27th Street New York

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Send for new illustrated catalog showing latest reduced prices. It's Free.

10 days' trial given

SENECA CAMERA MFG. COMPANY
306 Central Avenue Rochester, N. Y.

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Make This a Big Season!

TRAP early and long! Get full value by shipping to McCullough & Tumbach. Our graders know the market—they pay every cent a skin will bring.

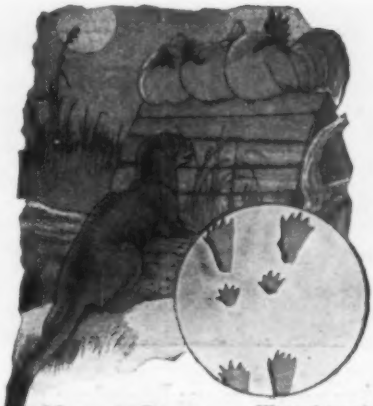
We guarantee our prices to top the market—and your check goes out the day the furs come in.

SHIP FURS NOW!

For 31 years our business has grown by honest dealing. Ask any old-timer—then send us a shipment. The check will prove every word we say.

Free: Shipping tags, price lists; trappers' supply catalog.

McCULLOUGH & TUMBACH
129 N. Main St., St. Louis, Mo.



Nature's Rogues Gallery No. 6

Weasel tracks—two-fifths actual size

The Weasel—One of the most ferocious little beasts alive. Kills from sheer lust of slaughter.

A sure way to bring down nature's thieves

—*a sharp-shooting Sporter*

THERE are over thirty relentless birds and beasts that prey upon our crops and useful wild life. Stop this destruction with your Savage Sporter.

In this trim little rifle you have six shots always ready—and a smooth gliding bolt-action that will feed them up quickly and surely. And as for accuracy—that's the Sporter's middle name—for it's built with all the finest features of military rifles—to shoot *straight*.

Just take one look at the lines of this trim little beauty. Not an extra bit of weight anywhere—yet steady and true to hold.

No matter what you want to shoot—no matter what you want to pay—you will find a Savage .22 that is just what you're looking for. Write us today to send you an illustrated catalog describing Savage firearms.

SAVAGE ARMS CORPORATION
Dept. 21, Utica, N. Y.
Owners and Operators of the J. Stevens Arms Company

The Savage Sporter

Bolt-action repeating rifle, round blued barrel, genuine American walnut stock, varnish finish, pistol grip, interchangeable magazine.

Model 23A	*.22 cal.*	*$19.50*
Model 23B	*.25-20 cal.*	*23.50*
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SAVAGE STEVENS

DEAF?

Then here's a new deal and a Square Deal

Amazing new hearing aid —finest and smallest in the world

AT HALF USUAL PRICE

FREE FULL WEEK'S TRIAL

Physicians and deaf folks have long complained of the high prices of hearing aids. Now this protest has been answered by a new and tiny device called THE AURIS —*priced at less than half the price of other methods.*

But the AURIS has gone further than substantial price reduction. It has fulfilled the dream of all Aurists and ear-specialists for a perfect hearing aid—*in minimum size and weight.*

Although the smallest device of its kind in the world, it is the most powerful and efficient. Worn practically concealed, it acts as a third ear to the deaf — enabling impaired ear nerves to hear any sound a normal ear can hear — clearly, distinctly, resonantly, without mechanical distortion. Gives *natural* hearing, with full tone values. Perfected by Radio Engineers from new Radio sound principles.

Know the happiness of clear, easy hearing again. End the lonely isolation of deafness. You may try THE AURIS a full week without a penny of risk or expense. Without a deposit or payment of any kind. Just send your name, address and free trial request to THE AURIS COMPANY, Room 405-F, 141 W. 40th St., New York City. If the Auris does not make you hear, return it and you will not be charged one cent.

AURIS

SCIENCE'S NEW GIFT TO THE DEAF

TRY IT A FULL WEEK FREE

SWEATERS Any Style or Design for Men, Women, Boys, Schools, Clubs, Teams

Order direct from mill. Save 20% to 30%. Any style, color or size, from stock or to order. Finest virgin wool. Send now for free catalog of big bargains. Special offers to schools, clubs, teams.

AMERICAN KNITTING MILLS, 1538 Clybourn Ave., Dept. 40, CHICAGO

At least 20% Coal-Saving Guaranteed

to every user of the CROWN *Fuel Saver*

Put that 20% saving in dollars and cents. Figure it up on the amount you spent for coal last year. Add up how much a 20% coal saving means to you over a five or ten year period—and you'll decide that the inexpensive CROWN Fuel Saver is worth while investigating.

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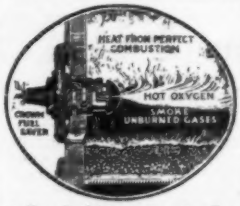
The CROWN guarantee is absolute. Attach this amazing coal-saver and heat-producer to the feed door of your heating plant and you must make an actual saving in fuel of at least 20%—or your money will be refunded without question. 20% is the minimum coal-saving possible with the CROWN; some users obtain yearly savings of 30%; others as much as 50%.



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Get cleaner, steadier heat that will keep your home comfortably warm; make less trips to fire the furnace; eliminate smoke and deadly gases by attaching the CROWN to your furnace. **Write today** for full details of this **guaranteed** coal-saver and heat-producer.

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Distributors Wanted. High-grade men can build profitable businesses in their communities. Write for interesting proposition.

Ranger $5 a Month

Finest bicycle built—44 Styles, colors and sizes. Factory-to-Rider prices. FREE delivery, express prepaid on 30 Days Free Trial. Cash or easy payments. Bicycles, $21.50 and up.

Tires lamps, wheels and equipment at half usual prices. Send no money. Write today for big catalog, special factory prices, *free trial plan* and marvelous offers.

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Write today for free Ranger Catalog, factory prices and marvelous easy payment terms

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Your skin can be quickly cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Enlarged Pores, Oily or Shiny Skin. $1,000.00 Cold Cash says I can clear your skin of the above blemishes.

FREE WRITE TODAY for my FREE Booklet—"*A Clear-Tone Skin*"—telling how I cured myself after being afflicted for fifteen years.

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"If I hadn't been all through it myself, I wouldn't have the assurance to say to you 'cheer up.'"

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The Beginning—1892

Those who wear them say:

ERICKSON LEGS are Wonderful

because they do not chafe, overheat or draw end of stump.

If you have had a recent amputation send for new booklet on TEST LEGS for beginners.

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Genuine KEYSTONE MOVIEGRAPH

(PATENTED)

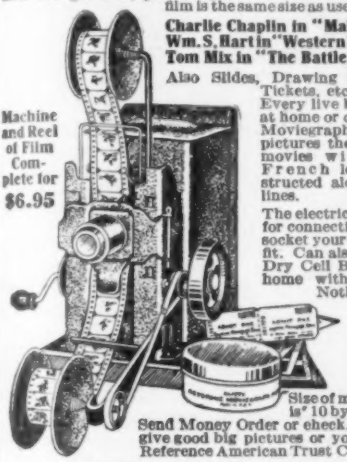
SHOWS BIG SIZE MOVING PICTURES

Safe for the Home $6.95 Non-Inflammable Safety Films Reel of Tom Mix Given FREE

The following reels are only a few in the film catalogue, and are genuine, posed by the actors themselves. The film is the same size as used in the theatre.

Charlie Chaplin in "Making Pies"
Wm. S. Hart in "Western Train Robbery"
Tom Mix in "The Battle on Horseback"

Also Slides, Drawing Slides, Theatre Tickets, etc., included.



Machine and Reel of Film Complete for $6.95

Every live boy should have at home or club a Keystone Moviegraph that shows pictures the same as in the movies with powerful French lenses and constructed along professional lines.

The electric cord is included for connecting to any lamp socket your electric bulb will fit. Can also be had for any Dry Cell Batteries for the home without electricity. Nothing to get out of order. No complicated parts. We have the largest comedy film service in the country for home machines. Size of machine all set up is 10 by 8". Weight 3 lbs.

Send Money Order or check. Guaranteed to give good big pictures or your money back. Reference American Trust Co., Boston Mass.

Order your machine today in time for Christmas

Price for Machine and Reel $6.95 complete, prepaid in U. S. Genuine Keystone Moviegraph Patented 1919, 1920, 1921.

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AGENTS 500% PROFIT

GENUINE GOLD LEAF LETTERS

Guaranteed to never tarnish. Anyone can put them on stores and office windows. Enormous demand, large profits. Paul Clark says: Smallest day $28.70. R. L. Reel made $920 in two months. Write today for free sample and liberal offer to general agents.

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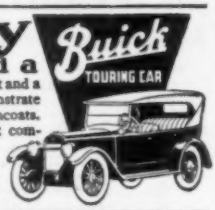
Write today for offer. $8.00 a day to start and a Buick touring car if you make good. Demonstrate and take orders for Comer All-Weather Raincoats. Permanent, high-grade business. Largest company of its kind in the world. No experience required. We furnish complete outfit and instructions. Write now.



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Pays $10 to $20 Day Profit

Pays Rent for Store Owner

Install one in your store or any public place and get this easy money. Requires no attention. Always works. Machine's profits pay the rent. Write us about rebuilt penny and nickel machines. Finished like new. In excellent running order. Pay their cost in 10 days.

Write or wire today for full particulars. $25 down payment. Balance C. O. D. Export orders full down payment. Mints $15 per case, 1,000 5 cent packages. Single boxes, 100 5 cent packages, $1.50.

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Buy of **LOFTIS**, the Direct Importer. Our Diamonds are exquisitely beautiful, high-grade, QUALITY gems, Blue White, of dazzling brilliancy—the finest offerings of the European Diamond markets. Personally selected by our expert Diamond buyers.

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17-Jewel Elgin
Guaranteed 25 Years

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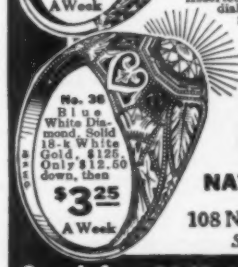

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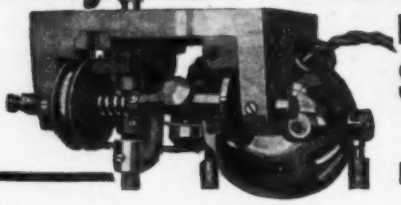
LOFTIS BROS. & CO. EST'D 1858

NATIONAL JEWELERS
DEPT. G-994
108 N. State St., Chicago, Ill.
Stores in Leading Cities

Send for Christmas Catalog today

Only 127 Motors Left at $10 Each



Ideal for home-made phonographs, experimental purposes and combination **phonograph-radio** sets.

We have 127 small motors which are greatly under-priced for quick clearance. You will never again equal this low price, when this lot is sold.

They are **universal motors,** 110 volts, 60 cycle single phase, complete with turntable, cord and socket for immediate use. 1400 R. P. M. Motor has 1" pulley with flange for ¼" flat belt. Housed in highly polished, nickel-plated shell.

Don't lose out on this remarkable offer. Order your motor today. Tomorrow may be too late. DO IT NOW! Price, **$10.00** f. o. b. Steger, Illinois.

Industrial Division

Steger & Sons Piano Manufacturing Company

Dept. 50, Steger Building **CHICAGO, ILLINOIS**

$1 down brings any Instrument!

Genuine Bacon Tenor Banjo

Choice of all famous Banjo Soloists. Most beautiful, sweetest toned. Brand new. $1 brings it! Balance 10 months.

$43.50

Our Liberal Terms

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The wonderful Sax with the human voice singing tone. Learn to play in a few lessons at home! It's a "Standard"—our own famous make—World's finest quality, brand new, only

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Slightly used, rebuilt like new, price less than one-half. Our catalog shows all musical instruments, brand new standard makes, and bargains in rebuilt instruments. This one only **$16.50**

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Our marvelous, practical Movie **Machines** sell as low as $3.75 postpaid, and use same size film as big theatres. We also have wonderful films at lowest prices—with a new film exchange service. **Don't Miss This!**

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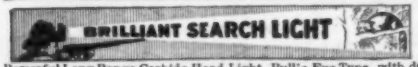
THE LYMAN ELECTRICAL MFG. CO.
Flatiron Building **New York City**



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EXCEPTIONAL BARGAIN $7.95

Limited Time Only

Gents' **14 kt. gold filled Watch.** Thin model, fancy engraved case. 10 jewel **Lever** movement, adjusted and regulated stem wind and set. Regular $18.00 value. Our special price only $7.95 plus 18c postage. **FREE** a handsome 14 kt. gold filled Waldmar chain and knife if you order promptly. Pay postman on arrival. Satisfaction guaranteed or money refunded. Watch set in handsome velvet lined gift case. Order today.

SUPREME JEWELRY MFG. CO.
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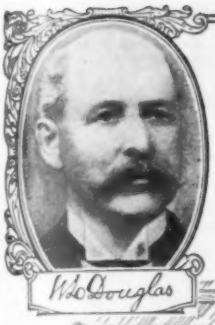
Dept. 153 **New York City**



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BOYS AT $4.50 & $5.00

Women of fashion should know that our women's shoes are high-class, made in the most distinctive, up-to-date and exclusive styles, which appeal to those who desire stylish, comfortable and serviceable shoes at reasonable prices.

New Tan Oxford *for Women* Attractive pattern in light Russia calf with Storm Welt, **$6.50**

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WEAR W. L. DOUGLAS SHOES AND SAVE MONEY

FOR 38 YEARS, W. L. Douglas' name and portrait have stood for quality, for economy and for satisfactory service. W. L. Douglas shoes are exceptionally good values. Only by wearing them can you appreciate their superior qualities. *The exclusive,* smart models, designed especially for young men and women, *are leaders everywhere.*

W. L. DOUGLAS **$7.00** SHOES are remarkably good value. Seldom have you had the opportunity to buy such *high-grade* shoes at this popular price. Shoes of equal *quality, comfort and service* are rarely found in other makes at our prices.

WHEREVER YOU LIVE, demand W. L. Douglas shoes. They are sold in *120* of our stores in the principal cities and by over *5,000* shoe dealers. For *economy* and *dependable value,* wear shoes that have W. L. Douglas' name and the retail price stamped on the soles. The *stamped price guarantees the value.* If not for sale in your vicinity, write for catalog.

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WITH OUR HELP—SAVE HALF

Choraleon Aristocrats are unexcelled. Play any record. Finest motor, tone arm, case materials, blueprint, full instructions at LOW COST. Write for catalog and FREE Blueprint offer.

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Salesmen wanted to sell Chase Furwove Motor Coats in every city and town in the United States. A splendid opportunity for salesmen seeking a proposition which will net $60.00 to $150.00 per week. For particulars, write to The Owen Company, 99 Chauncy St., Boston, Mass.

FREE Your Name Inlaid in Gold A $1.75 VALUE NEVER SOLD FOR LESS

YOUR NAME HERE

THE PERFECT WRITING INSTRUMENT

The New Improved **INKOGRAPH** Writes like pencil with ink better than good fountain pens. Won't skip, blot, scratch, leak, clog or soil hands. Makes 3 or 4 carbons. 14 kt. gold point, shaped like fine lead pencil point. **Guaranteed. SEND NO MONEY.** Pay postman $1, plus postage. Agents wanted. $1

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PLAY INSTANTLY WITHOUT PRACTICE

PRICE CUT TO ONLY $5.95

JAZZ-BO SAX

Not a toy but a full throated, full sized quality built reed wind instrument. One that you can be proud to own and play. Substantially made with heavy highly polished throat and bell. Can be used for Solo work, accompanying, and in bands and dance orchestras. **You play the Jazz-Bo Sax at once—*the minute it arrives.*** No knowledge of music required, no tedious lessons or long months of practice, for with each Jazz-Bo Sax even at the new low price of $5.95 you get our wonderful Method enabling you to actually play popular Jazz the first time you take this handsome Sax in your hands. *Entertain others and be the envied center of attraction wherever you go.*

FREE Send today and you will receive **FREE** our wonderful new **Easy Method, 30 pieces of music,** and a **fine Carrying Bag** enabling you to take your sax with you wherever you go.

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SEND NO MONEY

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Make This 30 Minute Test

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Please mail without cost or obligation your beautifully illustrated literature and Free Trial Easy Payment Offer.

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Address.....

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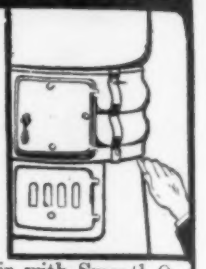
Instrument.....

BE YOUR OWN FIXER WITH SMOOTH-ON No. 1



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The Walton-Duplex Shirt is *reversible*—exactly the same on both sides. This means *double the wear* of any ordinary shirt. You are really selling two shirts for the price of one! Frank Cherne, Duluth, Minn., says: "I made $26.48 in commissions *the first day*. $625 in 40 days." You can equal or better his success.

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Build up a *big immediate income* selling the greatest development in men's shirts ever conceived. Fifty new fall patterns. Get our new booklet "Your Opportunity" and our unusually liberal proposition to wide-awake salesmen. Write AT ONCE.

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BURNERS make your old kerosene lamps and lanterns give a brilliant white light better than electricity or gas. Doubles your light. Saves oil. **NO MANTLE TO BREAK.** Guaranteed Safe and Reliable. Delights every user. Send now for complete sample postpaid 50 cents, stamps or coin. 3 for $1.25. **Money Back If Not Satisfactory. Live Representatives Wanted. Exclusive Territory.**
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200% PROFIT or more. 9 out of 10 women buy. Produces keen edge quickly. Sells for 50c.

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This $2 KNIFE $1.18 Postpaid

Hand Forged Razor Steel Blades

Handy shaped Blade makes this knife best for mechanics, sportsmen and farmers; light but strong; resharpened easily. Stag handle. German silver finish; blades file tested, hand forged from razor steel and warranted.

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Send for our 100-page List and *"HOW TO USE A RAZOR"* **FREE**

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14 Kt. White Gold Point. Chased Rubber Holder. Lever Filler. Pocket Clip.

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Your Name in Gold Inlay, 25c.

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Make Money Wearing THIS FREE CAP

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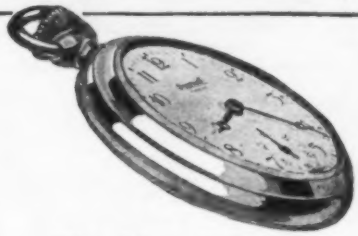
$10 A DAY EASY FOR YOU

Send Name Quick—No Money

McDonald made $58 in one week, Hampton made $7.65 in four hours. Schmidt increased his salary from $35 a week to almost $75! And you can do every bit as well. Send your name right away and I'll tell you how to make $10 a day, also secure a Taylor Cap for your use. Write at once. J. W. Taylor, Pres., Taylor Cap Mfrs., Dept. 8-W Cincinnati, Ohio.

For Christmas an Ingersoll



The New Yankee

$1.75

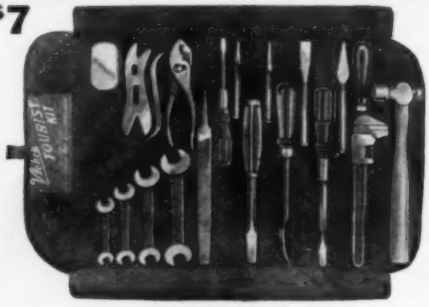
Dependable, as always, but with many new features of grace and beauty. With Radiolite dial that tells time in the dark, $2.75.

Waterbury Gold-filled

$9.50

4 jewels; stylish 12-size. Very modern green or white 14-k gold-filled case. Scratch dial. A handsome gift watch.

$7



A Kit of Twenty High Grade Tools!

WATCH Dad's eyes gleam when he opens it Christmas morning. A welcome, practical gift for any man! Twenty glistening, high grade tools, enough for most repairs and odd jobs, in a handy canvas case. This kit is made by the world's largest producers of tool kits. Specially priced at $7.00. Carton is wrapped in fancy holiday paper.

Other popular Tool Kits, all of Vlchek guaranteed quality:

No. 900	Mechanician Kit	$20.00
No. 902	Motorist Kit	15.00
No. 903	Garage Kit	11.00
No. 908	Taxi Kit	4.00
No. 909	Little Roadster Kit	3.00

If your dealer hasn't them tell us his name, enclosing correct amount and we will see that you are supplied.

The Vlchek Tool Company
3001 East 87th Street Cleveland, Ohio

EASY TO SAY VELCHEK
VLCHEK TOOLS

I MAKE $150.00 A WEEK SURFACING FLOORS

The "American Universal" Way

says Brooks, Okla. "My profits run from $35.00 to $50.00 a day and I have cleared as high as $180.00 in 17 hours," says Geseking, Ill. "I make at least $20.00 a day," says Phillips, Ohio. "I have made $30.00 in 8 hours," says Waynick, Texas. Hundreds of other fellows who have become "American Universal" Floor Surfacing Contractors, are doing as well, some even better.

More Good Men Needed

The field is unlimited, the demand for "American Universal" work tremendous in villages, towns and cities the country over. Every new floor must be surfaced, every old floor represents a re-surfacing job. "American Universal" (electrically driven) Floor Surfacing Machine does work of six hand scrapers, earns six men's pay. Work is pleasant, interesting, requires no experience, no special training. Small amount starts you.

Here's Your Big Opportunity to get into something for yourself, be your own boss and make real money. We help you get started, show you how and where to get work, furnish office forms, stationery, advertising, everything you need. It's the big chance you've been looking for—Grab it.

Write now for free details of this rare opportunity.

The American Floor Surfacing Machine Company
523 S. Saint Clair Street
TOLEDO, OHIO

It is the well known quality of CRESCENT machines that justifies you in selecting one of them each time you have need for wood working machinery. The CRESCENT line is better than ever and will always give you satisfaction in every particular. Ask today for catalog of band saws, saw tables, jointers, shapers, planers, borers, planers and matchers, swing saws, disk grinder, cut off table, hollow chisel mortiser, variety wood worker, Universal wood workers.

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in Office and Shop can be instantly made with the Midget Slide Rule. It gives the answer to any problem involving fractions, mixed-numbers, decimals, whole-numbers, roots, powers, Logs. and Trig. Functions. Thousands of these rules are used by Accountants, Engineers, Clerks, Students, etc. It is the most versatile calculator ever invented. If you have any figuring to do, order a Midget Slide Rule on trial. Made of aluminum with figures on white celluloid. Size 4". Price with Instruction Book, **$1.50.** Leather Case, **50c** extra. *Catalogue Free.* Sent C. O. D. if desired.

Your money back if you are not satisfied.

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MASTER SLIDE RULE

Takes accurate inside or outside measurements

Works fast. Slides in and out quickly. Durably made of brass trimmed boxwood. Any length 2 to 8 feet, 20 cents per lineal foot. If not at dealer's, sent postpaid.

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"Saws in the Shop," "Saw Sense," "Saws on the Farm;" just send your name and address, and say which of these helpful books you want—and we will send it FREE.

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Every Purchaser Finds Numerous Uses for the

Torit Acetylene Torch No. 13

Uses Acetylene only. No oxygen or air pressure is required. Tips suck in air. Simply connect to Presto auto tank, light gas, and the outfit is put to work. *Beats anything you ever tried for soldering, heating or light brazing.*

Outfit consists of 4 tips for different kinds of work, soldering copper, 5 feet tubing, tank connection, and full instructions.

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You can get yourself no **Better Christmas Gift** than **A Gerstner Tool Chest**

Ideal for Toolmakers and Machinists.

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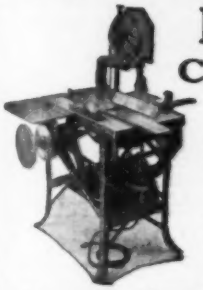
For your home shop!



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Cabinet Shop Special

$225.00

with all attachments and motor

Here's an all-round woodworker for the small shop. Sturdy, fast and true. The biggest little woodworker ever built. Saw table has 8-in. rip and cross-cut saw, and 4-in. jointer and borer. You can choose from these extra attachments: band saw; shaper; sander; lathe; and motor.

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The Parks Ball Bearing Machine Company
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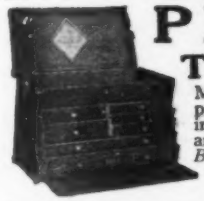
PARKS
WOODWORKING MACHINES



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EVERY man—from fifteen to fifty, and beyond—who ever has occasion to touch an automobile, motorcycle, motorboat, to tinker about his own workshop, to do odd jobs of repairing about the house or on farm machinery, will be tickled to get this handy kit of genuine Crescent tools.

Eight-inch wrench, six-inch pliers, and Crescent all-steel T-type screwdriver. All covered by the Crescent guarantee of satisfaction. In attractive holiday box, at hardware or accessory stores, $2.35.

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Originators of the Crescent Wrench

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Start every work day—or play day with a pair of Bernards (No. 102) at your finger tips. You'll find a dozen uses for them. They grip like a vise because of the parallel jaws. The *outside* cutting blades bite cleanly through metal. They are great for bending or stretching wire. Insist upon

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White Gold Wrist Watch

25 year 14K white gold-filled case, richly engraved, latest Tonneau shape, sapphire crown, gros grain ribbon with white gold-filled clasp, 6 jewel movement. An excellent timekeeper. Comes in beautiful velvet and silk-lined case.

AN IDEAL GIFT

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..for *his* Christmas

The **Simore Screwdriver** or **Combination Knife** and **Screwdriver** make an ideal gift for the man or boy. Model No. 11 has three screwdriver blades; No. 12 has a fine knife blade and two screwdriver blades — both unusually useful and beautiful tools — blued steel handles—best steel in blades. They look the part of a real gift for the boy or man who likes tools—try one on a friend of yours and watch him register joy. He'll do it, too.

Model No. 11 only **$1.50**, and No. 12 for **$1.60**. Send money order or your check and we will mail post prepaid at once. Each tool guaranteed — your money refunded if not satisfactory.

The Tools That are Different

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Earn $500 a Month With New Gasoline Tonic

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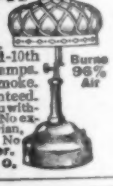
We Pay $12 A DAY

Introduce this wonder lamp in your locality. **Make $72 a Week.**



Burns 96% Air

Brilliant, white light—soft, restful to eyes. Equals safety, brilliancy of electricity. 1-10th the cost. 20 times brighter than wick lamps. More healthful. Easy to operate. No smoke. No soot. No odor. Low priced. Guaranteed.

FREE Outfit to workers. New plan starts you without capital. Full or spare time. No experience needed. Profits start first day. Vivian, made $400 easily in few days. So you can do it. No charge for territory. Write for **Free Outfit Offer.**

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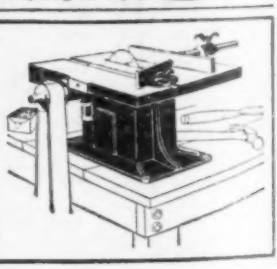
THE EASIEST WAY TO DO HARD JOBS

"Buzz Boice" Laughs at Labor

"Buzz Boice" will take the hard work out of hundreds of jobs with a

Boice-Crane Junior Bench Saw

This sturdy precision machine will saw, sand, grind, miter, rabbet, tenon and perform many other operations with ease and accuracy. Saws 1½-inch stock. Dadoes ⅝" x ⅝". Driven by ⅓ h. p. motor attached to any light socket.



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Write for descriptive folder on bench saws, band saws and jointers.

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"Largest Builders of Small Bench Machines in the World"

SAWS AS MUCH AS 10 MEN!

One man, now, can saw 15 or more cords of wood each day with the OTTAWA Log Saw. No more back-breaking work with a cross-cut saw; no more lugging logs to a circular saw, for it's easy to take this power saw to the wood. Over 26,000 in use. Thousands *making big money* sawing wood for neighbors and to sell. Coal is high and may be higher—wood is in good demand for fuel. Send your name on a post card today for full particulars about the—

OTTAWA '4 in 1' LOG SAW

1—Cuts Down Trees
2—Saws Logs
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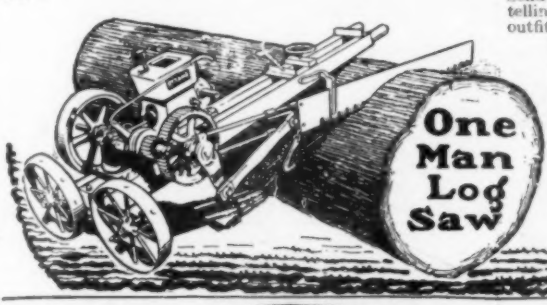
Faster sawing; easier moved—easy to start in any weather. 4 H. P. Kerosene Engine—you need plenty of power. Shipped quick from nearest to you of nine branch houses.

Get Big Special Factory-to-User Offer!



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Limo weather-proof sections will change your 1923-1924 Ford Touring or Roadster, into classy limousine-style closed car. Doors open from outside. Sliding front panels for ventilation. Three-ply, double covered veneer frames. Color matches your top. Easily, quickly installed. Guaranteed. Low priced. Fine for bad weather. *Write for prices.*

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to use and introduce attachment that makes Fords run on 94% air. THERMOSTAT on exhaust automatically turns down needle valve as engine warms, exactly as Ford Manual says do by hand.

Makes Fords start easier winter or summer—saves half gas and oil—cuts repair bills one-half—eliminates carbon formation, prevents dilution of crank case oil. Installed in two minutes.

The FORDS SAVINGS BANK

BLANCKE THERMOSTATIC CARBURETER CONTROL

An Automatic Carburetor Control for Ford Cars and Trucks

Sells on sight to every Ford owner as easily as giving him a $100 bill, because it saves $100 every 10,000 miles.

You can make Big Money selling this wonderful proven device. Experience not necessary. Blancke plan will start you without capital in a business of your own that makes you from $250 to $2,000 a month profit.

Write for free circulars Now!

Cadillac now uses as standard equipment Thermostatic Carburetor Control under Blancke license.

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Famous Red-i-Kut life-size patterns and picture instructions show you how you can easily convert your Ford into this **Fast, Saucy, Sport Car** so thousands have done, with easily obtained materials. No need to lay up the car.

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Only $6.40 delivered. Order **now** while we can make good delivery, and really enjoy these wonderful days in your "Pal." **Keen, Classy, Up-to-the-minute. You can build it. Over 11,000 in use. Don't hesitate.** "**Swing Lo**" **Undersling irons, no frame cutting kind,** only **$6.50.** *Send 5c coin for new manual of other distinctive sport body patterns from $3.00 up*—"*RKO*" *Steel,* "*Swing-Lo*" *Irons,* "*Jiffy*" *Tops and* "*Gneum*" *Windshields. Order Right Now.* **Kuempel Co., 55 Kuempel Bldg., Guttenberg, Iowa**

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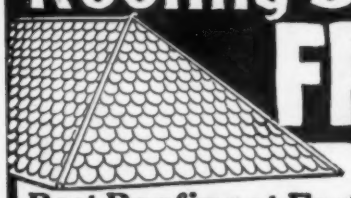

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Don't buy Roofing of any kind until you get our big Free Roofing Book, describing full line of Edwards Famous "Tightcote" Galvanized Roofings, Sidings and Ceilings, and our lowest factory prices. Then see for yourself how much we save you by selling direct and saving you all in-between dealers' profits.

EDWARDS "REO" Metal Shingles

Absolutely rust proof. By our patented "Tightcote" process, edges as well as sides of metal sheets are heavily coated with zinc—not a space the size of a pin point exposed to weather. Fire and lightning proof. Outlasts three ordinary roofs. Forever wind and weather proof. Need no repairs—end all roofing expense. Patent INTERLOCKING DEVICE makes water tight seams—all nail heads covered—no chance for rust or leaks.

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Edwards "Tightcote" Galvanized Roofing can be bent, twisted or struck by lightning, and the galvanizing will not crack or flake. Bend it or hammer it—you can't loosen or scale the galvanizing. No other galvanized roofing can withstand this test.

Low Priced Garages

Wide variety of styles, all sizes of Portable Fireproof Metal Garages. Lowest prices ever made. Postal brings Big Garage Catalog free.

Write Today for free samples and proof that we can save you a lot of money on any kind of roofing siding or ceiling you may need. Ask for Roofing Book No. 154.

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SEND $2 DOWN

PAY $6.70 PER MONTH

Seven brilliant, blue white, perfectly cut diamonds are set in platinum. Looks like 2 ct. solitaire worth $600. Fully guaranteed to stand any test.

TWO BLUE SAPPHIRES are set in the shanks of this 18 kt. solid white gold engraved and pierced ring to add beauty and style.

FREE TRIAL — NO RED TAPE

Just send $2.00 deposit to show your good faith (or pay postman $2.00 on delivery) and we will send this handsome diamond ring. (Men's heavier ring, same price.) You can pay balance in **ten small monthly installments of $6.75 each**—total price, $69.00. Former price, $100.

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No one knows you are buying on our dignified credit system unless you tell them yourself. **A written guarantee accompanies each ring.** You can return the ring within ten days if you are not satisfied. No risk. No delay. **Makes a splendid present.**

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⅛ Carat	$25.00	¾ Carat	$147.75		Guaranteed genuine
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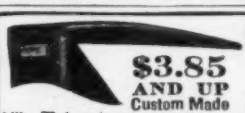

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MAKES YOUR BIKE A MOTORCYCLE!

A high grade 2½ H. P. motor attachment quickly clamped on any bike frame. Speed 4 to 40 miles an hour. 90 to 125 miles per gallon of gas. **Special Low Price Now!** Write today for Complete Description and Special Low Prices on SHAW Motor Attachments and the SHAW Complete Motorbicycle.

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Starts Easy at Zero

with Air Friction Carburetor

We guarantee all other cars nearly double present mileage, power and flexibility. Models for any car, truck, tractor, marine or stationary engine. Makes old cars better than new. See our mileage guarantees.

Ford	34 mi.	Chevrolet	32 mi.	Dodge	28 mi.
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Mileage guarantee on any other car sent on request.

SENT ON 30 DAY'S TRIAL You can drive any car in heaviest traffic without shifting gears. Starts off on high in any weather without priming or heating—No jerking or choking. Agents Wanted.

AIR-FRICTION CARBURETOR COMPANY
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Boys, you yourselves can build this Steam Shovel —*and it works!*

Yes—this Shovel really works just like a big one. It's great fun to make it scoop up a load—then swing and dump its dipper. And you can build it yourself—with Meccano. Then, when you're through with it, build a Skyscraper, Crane, Bridge—for Meccano is composed of real engineering parts in miniature with which you can easily build hundreds of models. Parts are strong and accurately made and fit together perfectly.

No study is needed, for every Outfit has a big picture book that shows you just how to put models together.

For sale at most department, toy, hardware and sporting goods stores. Sent direct on receipt of price if your dealer cannot supply you. Prices of outfits from $1.00 to $45.00.

IMPORTANT NOTICE

Not all construction toys are Meccano. Meccano is the original Steel Construction Toy, has the greatest variety of parts and builds the most models. Insist on the genuine Meccano. This label is on every box.

MECCANO

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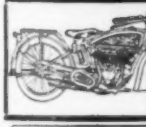

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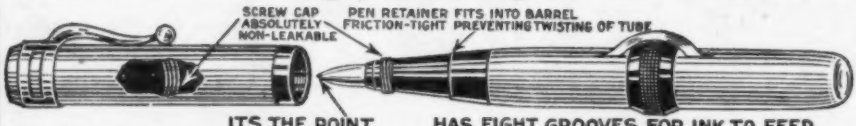

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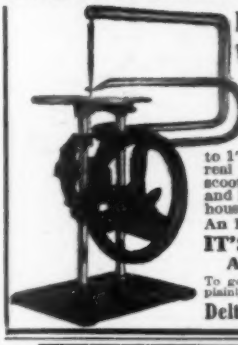

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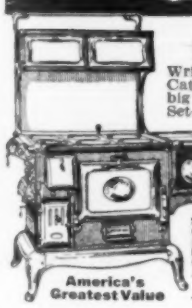

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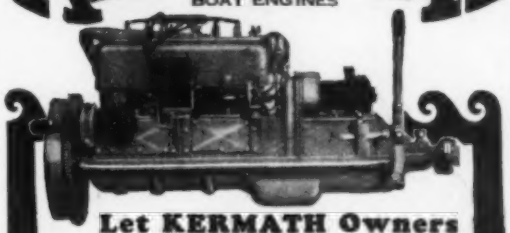

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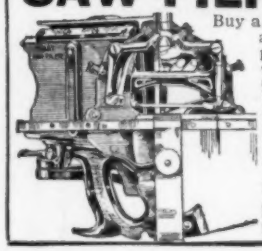

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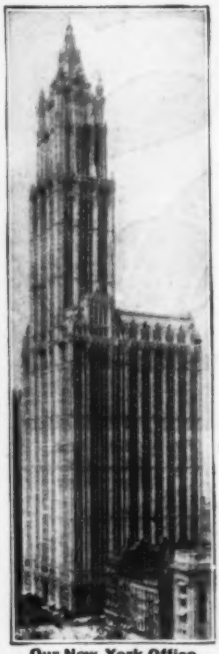

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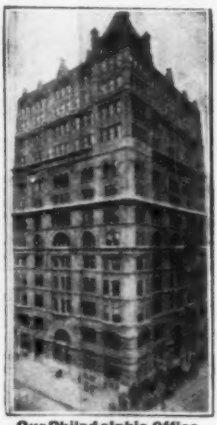

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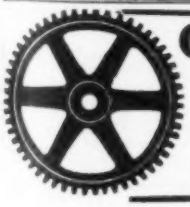

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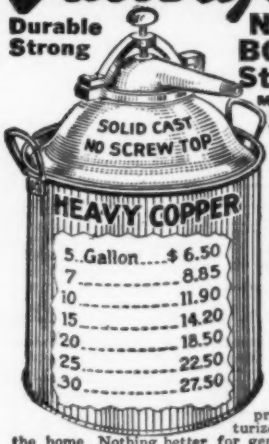

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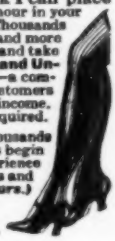

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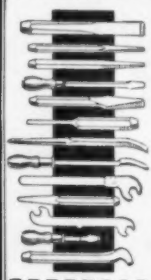

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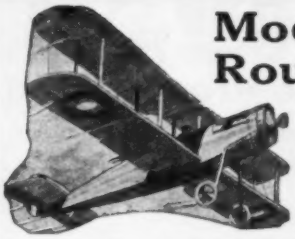

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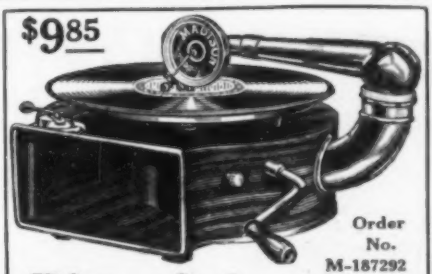

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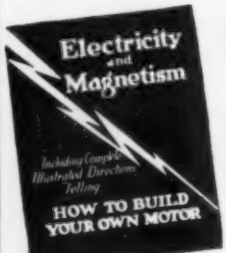

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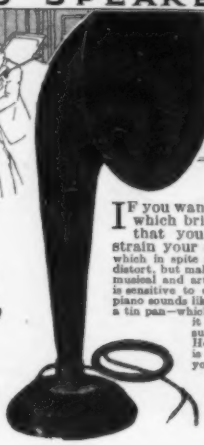
Holtzer-Cabot

LOUD SPEAKER

A New Standard of Quality

ONLY $12.00



IF you want a Loud Speaker which brings in volume so that you don't have to strain your ears to hear it—which in spite of its power does not distort, but makes Radio reception a musical and artistic pleasure—which is sensitive to every tone so that a piano sounds like a piano and not like a tin pan—which is so beautiful that it harmonizes with any surroundings, this new Holtzer-Cabot National is the Loud Speaker for you. Furthermore, its price—$12.00—has established an entirely new standard of value in Radio

Dept. P. M.

THE HOLTZER-CABOT ELECTRIC CO.
125 Amory Street BOSTON — 666-65 South State St. CHICAGO

Holtzer-Cabot

Big Catalog FREE

ABSOLUTELY FREE
Thousands of
RADIO BARGAINS

You Can't Equal This Anywhere
SRACO head sets—2000 Ohms—head bands and cord complete. Extremely sensitive. Write Dept. 12 for wonderful catalog. **$2.69**

STANDARD RADIO CORP.
227 WEST MADISON ST. CHICAGO

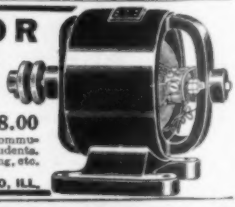
DYNA-MOTOR

As a dynamo it will operate induction coils, light lamps, charge storage batteries, electroplate, etc., makes an ideal machine for experimenting. As motors they will operate heavy models, emery wheels, and other appliances.

16 Watt Dyna-Motor **$6.50** 32-Watt Dyna-Motor **$8.00**

64 to 200 Watt Dynamos, Armatures, Commutators, Punchings, Parts for Schools and Students. Send 6c for Catalog to cover cost of mailing, etc.

LOONIS ELECTRIC COMPANY
1427 N. Artesian Ave. CHICAGO, ILL.



Buchstein's Fibre Limb

is soothing to your stump—strong, cool, neat, light. Easy payments. Braces for all deformities.

Send for Catalog Today

D. BUCHSTEIN CO.
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Rush your name and address and learn how to get this handsome 14 Kt. gold filled man's watch and chain ABSOLUTELY GIVEN. Watch has 10 jewel Lever movement. Write today—don't delay for FREE watch plan.

RELIABLE SALES CO.
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BARGAIN CATALOG

Yours **FREE!** **100 Pages!**

Just send your name

Get it NOW! **Crammed full of information and offers** of all kinds of complete **RADIO SETS, Parts and Accessories**

Only $21.95 for 1-tube outfit, receiver parts unassembled; often receives over 1,000 miles. **Only $53.75** for 2-tube outfit, receiver assembled; often receives over 1,000 miles on loud speaker. **Only $85.00** for 3-tube Neutrodyne outfit, receiver parts unassembled; has received England. These **prices** include all accessories, aerial, etc.—everything needed for receiving on head phones. Also, **Crosley receivers, 10% off,** 25 other popular **sets away down.**

Very interesting

It's easy to do business with us, for this is "The Radio House of Friendly Service." All goods offered subject to examination and approval. No money in advance. Quick shipment. We pay transportation anywhere in U. S. *Satisfaction or money back.* Your radio questions answered free. **Get this wonderful catalog**—you need it—**write today! Don't delay!**

(And will you be so kind as to add the names of several friends you believe will soon want radio goods? Thank you!)

LIBERTY MAIL ORDER HOUSE

Dept. 163Z, 106 Liberty St., N.Y.

TOWER'S

OUR $200,000.00 COMPANY STANDS SQUARELY BACK OF EVERY HEADSET

WORLD'S GREATEST HEADSET VALUE

Sale $2.95, with Notable Improvements
Longer Cord (full 5 feet), Stronger Magnets, Higher Resistance, Increase of Sensitivity, Perfect Tone Match
EVERY SET TESTED BY LICENSED RADIO OPERATORS

Send no money - Order on a Post-Card

THE TOWER MFG. CO. Dept. P, 98 BROOKLINE AVENUE, BOSTON, MASS.

Scientific

Como Duplex Transformers

(Push Pull Power Type)

Price $12.50 Per Pair

The Como Duplex system of audio frequency amplification (push-pull) gives the maximum volume without distortion and tube noise. There is a combined filtering action which assures perfect results when ordinary amplification transformers fail. Can be used as a single-stage, two-stage, or a three-stage amplifier.

The World's Standard Push Pull Transformer

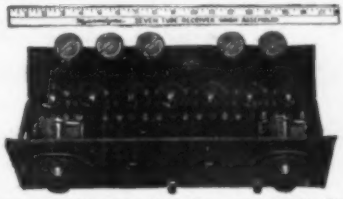
Send for copy of "How to Build a Power Amplifier."

COMO APPARATUS CO.

446 Tremont Street - BOSTON, MASS.

APEX VERNIER DIAL

Do not bother with geared condensers, requiring many holes in the panel and careful lineup of pinion shafts, when this marvelous instrument provides the fine adjustment for tuning in distant stations. Ratio 10 to 1—quickly applied to any shaft. For sale by all good radio dealers. If unable to obtain, fill in coupon and enclose $2.50 for nickel finish or $3.50 for Gold Plated finish.



Coast To Coast On An 18-Inch Loop

Assemble Your Own 7 Tube Super-Heterodyne

—on a 7 x 18 panel in three hours. $97.50 buys the parts complete, including drilled and engraved panels, condensers, sockets, transformers, dials, connecting plugs, cables, etc., with drawings, diagrams and instructions. Price of cabinets to fit—furnished on application. If your dealer cannot supply these parts for this complete Microdyne Radio Set, fill in coupon, mail check or money order and send dealer's name.

Apex Electric Mfg. Co., Dept. 1201, 1410 W. 59th Street, Chicago, Ill.

Gentlemen: Enclosed find $.....for which send me.....

.....

Name.....

Street.....

City.....*State*.....

Catch Everything in the Air!

Keep your radio batteries charged—and you won't miss a thing.

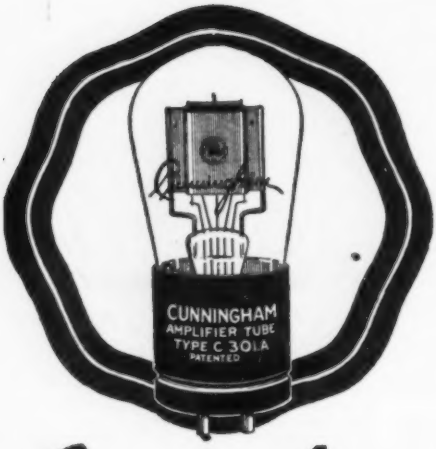
APCO Battery Charger does the trick over-night for less than 10c per battery. It's noiseless, clean, compact. Connects with ordinary light socket as easy as an electric "flat."

Write for interesting circular and nearest dealer's name.

APCO MFG. CO., New York Ave., Providence, R. I.

APCO BATTERY CHARGERS

for "A" and "B" Batteries



Cunningham RADIO TUBES

Quality Plus Service

Since 1915

The General Electric Laboratories produce these tubes which "Since 1915"—a Radio Lifetime—have consistently made good their claim of exceptional accuracy.

Price the same on all Five Types

C-301A C-299 C-300 C-11 C-12

Patent Notice: *Cunningham tubes are covered by patents dated 2-18-08, 2-18-12, 12-30-13, 10-23-17, 10-23-17, and others issued and pending. Licensed only for amateur experimental and entertainment use in radio communication. Any other use will be an infringement.*

Cunningham 40-page Data Book fully explaining care and operation of Radio Tubes now available by sending 10c in Stamps to San Francisco Office.

E. T. Cunningham Inc.

HOME OFFICE SAN FRANCISCO CHICAGO NEW YORK

LATEST WHOLESALE RADIO CATALOG

FREE Simply send name TODAY for big 48-page catalog of latest radio goods at Wholesale.

Live dealers and agents wanted.

STANDARD RADIO CO., 102 East 13th, Kansas City, Mo.

RADIO TEXT BOOK & CATALOG FREE

Contains—

75 Radio "Hook-Ups"
300 Illustrations
556 Articles
84 Pages

"Build Your Own with RASCO Parts"

RADIO SPECIALTY Co.

98-E Park Place, NEW YORK, N. Y.

$3.50 Each

RADIO Storage "B" Battery

12 Cells 24 Volts *Lasts Indefinitely—Pays for Itself*

For a limited time only, and to introduce this new and superior Storage "B" Battery to the public, we are selling it direct to the consumer for $3.50. Regular retail price is $5.50. You save $2.00 by ordering NOW!

Equipped with *Solid Rubber Case*, an insurance against acid and leakage. Extra heavy glass jars. Heavy, rugged plates.

Takes place of dry "B" batteries and will last indefinitely. Recharged at a negligible cost. Eliminates many noises so often blamed on "static". Order yours *today!*

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. EXTRA OFFER: 4 batteries in series (96 volts), $13.00. Pay Expressman after examining batteries. 5 per cent discount for cash with order. Save $2.00 by ordering NOW!

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 6, Chicago, Ill.

Makers of the Famous World Radio "A" Storage Battery.
Prices: 6 volt, 100 Amp., $12.50; 120 Amp., $14.50; 140 Amp, $16.00. Guaranteed in writing for two years.

World FOR RADIO STORAGE BATTERIES

KDKA - WEAF - WGN - WJS - KHJ - KGO - KFAF - WJY - KOF

FARAWAY RADIO

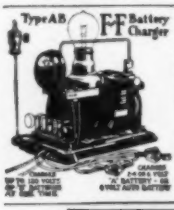
$29.50 Gets stations Far and near Loud and Clear

FARAWAY Radio Sets are amazing values at bargain prices. Users get stations from New York to Frisco—loud and clear. Operate with either dry cells or storage batteries. Beautiful cabinet finished in mahogany with new platinum-finished panel. SATISFACTION GUARANTEED Don't pay $100 to $150. Write for our *money-saving plan* and literature.

2-Tube Set - $29.50
4-Tube Set - 59.50

Dealers - Agents: Biggest possibilities you ever heard of. Write for plan and territory quickly.

THE FARAWAY RADIO CO., 662 W. THIRD ST., CINCINNATI, O.



The Triple Duty Charger

Charges radio 2, 4 or 6 volt "A" battery, radio "B" battery up to 120 volts and auto batteries from lamp socket. Average cost per charge about a nickel. Solidly built—will not get out of order. Fool-proof and simple. The first successful charger—introduced over ten years ago. Type A. B., price $20; West of Rockies, $21. Type 6 for 6 volt "A" or auto batteries, price $16; West of Rockies, $16.50. "B" battery charging attachment, $2.50 extra. Write for literature and name of dealer who will supply you with the genuine FF charger.

FRANCE MFG. CO.
10424 Berea Road CLEVELAND, OHIO

RADIO ENCYCLOPEDIA

FREE! Thousands of radio bargains, standard sets, standard parts for sets, vacuum tubes, etc., at one-third less than regular prices, also latest information on all circuits, complete List of broadcasting stations and other valuable data. Send name and address, we'll send you 50c book FREE! **FREE SERVICE DEPARTMENT.** Mr Decker of N Y Evening World will help you solve your radio problems, and furnish up-to-date information on set construction, operation improvements. This service **FREE** to our customers. Write today!

NORWALK RADIO CORP
Dept. 56 66 READE ST., NEW YORK

DEALERS SAVE MONEY

By Ordering from Our Bargain Catalog of Nationally Advertised Radio Goods. *Write for It Today!*

AMERICAN RADIO MFG CO.

Dept. O 6 WEST 14TH ST. KANSAS CITY, MO.

19.95 1-TUBE RADIO SET COMPLETE

with 6.00 phones, tube, A and B Battery and complete antenna. Gets local stations without an aerial. Highly selective. Fine volume. GUARANTEED.

A WONDERFUL XMAS GIFT

SENSATIONAL BARGAINS!

on nationally advertised sets complete, ready to operate. Also on accessories alone. Look at these amazing values.

59.95 for guaranteed, highly selective coast-to-coast 4-tube set complete with 9.50 loud-speaker, 6.00 phones, 3 dry cells, 90 volts, B Battery, 4 tubes and complete antenna. **For operation with storage battery, 69.95 complete.**

49.95 for guaranteed, highly selective coast-to-coast 3-tube set with 9.50 loud speaker, 6.00 phones, 67½ volts B Battery, 3 dry cells, 3 tubes and complete antenna. **For operation with storage battery, 61.95 complete.**

32.95 for guaranteed 2-tube outfit with 6.00 phones, 3 dry cells, 45 volts B Battery, 2 tubes, complete antenna. **For use with storage battery, 44.95 complete.**

6.00 Phones for **3.38** — 4.00 tubes for **3.00** and scores of other bargains. Sets also sold alone.

Send order direct and pay on delivery or write for FREE catalog. Reference: The Atlas Nat'l Bank of Cincinnati, O.

THE MELLODYNE RADIO CO.
Dept. B **CINCINNATI, OHIO**

Your Crystal Set

will work **400 to 1000 miles** if made by my plans. No tubes or batteries. Copyrighted plans $1.00. Satisfied customers everywhere. *Particulars free.*

LEON LAMBERT 539 Kaufman Bldg. WICHITA, KANSAS

Cut Prices on Radio

Save 25 to 50 per cent. Standard Sets, all types, $5.00 to $79.00. Everything in accessories Wiring diagrams and estimates free. 150,000 customers. Money-back guarantee. Immediate delivery. Illustrated catalog on request. Special proposition to community agents.

Radio Dept. 108

IMPERIAL LABORATORIES, Coca Cola Bldg., KANSAS CITY, MO.

Two Salesmen Hit Salina Not Long Ago...

They were selling household appliances from "door-to-door" . . . But the doorbells didn't ring loud enough . . . . or "Papa didn't love Mamma" enough . . . . 'er something! Anyway, Salina was the end of the trail . . . We started them selling BECK-NOR Systems—a little "fool-proof" accounting system for merchants, that is sweeping the country. And these two men—totally without experience in selling to merchants—each averaged above $100 weekly **real money** . . . . . We want more like them! Let us tell you about it.

The Beck-Nor Co.
118 S. 7th Street,
Salina, Kansas

FAHLBERG
MADISON, WIS.

for perfect Conductivity in Radio

Reddy HOT

Soldering Furnace

(Burns Denatured Alcohol)

AND TESTED SUPPLIES

Safe Soldering at Home. It is now possible for the amateur to get tight, clean joints in his home soldering that make the perfect conductive path necessary in radio work.

Mr. E. D. Fahlberg, former Professor of Metallography at the University of Wisconsin and Metallurgical Engineer with Western Electric Company, has developed Reddy Hot, the complete and safe home soldering furnace that this class of work demands. Reddy Hot will heat your iron ready to solder in *two minutes* and is

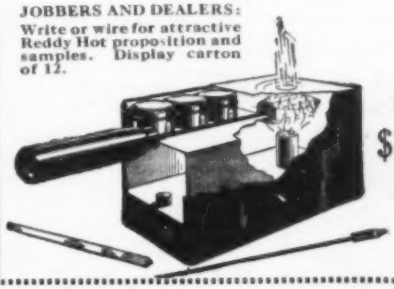
Safe — Non-Explosive — Portable

The complete Reddy Hot Soldering Outfit consists of the following: Large soldering copper, detachable handle—Fine soldering copper, detachable handle for delicate soldering—Reddy Flo Household Solder (highest grade general purpose solder on market)—Can Reddy Stik non corrosive Soldering Flux especially adapted for Radio—Can Reddy Prest Sal Ammoniac keeps tip clean and bright—Can Reddy Rub Abrasive Tape for quick cleaning and polishing. Complete directions with each outfit.

Ask your dealer for the Reddy Hot Soldering Furnace and supplies. If not obtainable we will send direct, for a short time only, on receipt of price.

E. D. Fahlberg Mfg. Co.
Madison, Wisconsin

JOBBERS AND DEALERS:
Write or wire for attractive Reddy Hot proposition and samples. Display carton of 12.



Price **$1.50**

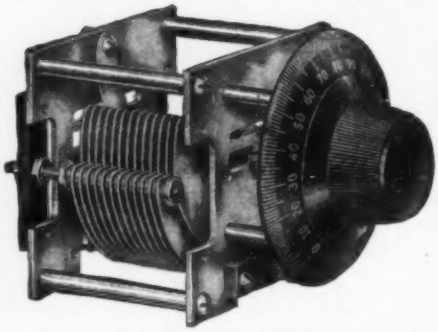
E. D. FAHLBERG MFG. CO., Madison, Wisconsin
Send me prepaid one Reddy Hot Soldering Furnace for which I enclose $1.50.

My dealer's name is.....

Signed: Name.....

Address.....

NATIONAL
VELVET VERNIER CONDENSERS AND DIALS



HAVE A VELVETY SMOOTHNESS HITHERTO UNKNOWN

They are made by skilled craftsmen — have the lowest losses and bring in distant broadcast with the least distortion. Home built sets using *Nationals* have received broadcasts from Paris—3,600 miles, and code from Buenos Aires—5,200 miles.

The condenser and dial chosen by Harvard University experts to demonstrate the Browning-Drake set before American Institute of Electrical Engineers.

SIZES:	.001	.005	.00035	.00025
PRICES:	**$7.00**	**$6.00**	**$5.75**	**$5.50**

DIALS ONLY 4' $2.50—3' $2.00

Interesting Bulletin covering Browning-Drake Receiver Free. Do not experiment with unknown products. If your dealer ca not supply you, write us.

The National Company, Inc., Cambridge 39, Mass.

FREE
Greatest Catalog of Radio Bargains

Send for It Today

It contains a thousand bargains of everything in radio: parts, supplies, complete parts for sets, complete sets, etc., also a mine of very latest information on all different circuits, complete list of broadcasting stations and other valuable data. Send your name and address and we'll send **FREE** catalog.

$3.95 without unit **$6.95** with unit

American Bell Loud Speaker

With American Adjustable Unit. Wonderful volume, clear reception. Speaks for itself without coaxing. 10-inch bell—made of non-vibrating material.

$2.45

HEADPHONES
"RandolphSpecial"

2200 Ohm moulded headset, properly designed to give strong and clear reception. Biggest headphone value ever offered.

Hundreds of Other Bargains

Our catalog is filled with bargains like these. Order direct from this ad. We prepay charges. Don't buy anything in radio before you see our catalog. **FREE Service Dept.**

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 252 CHICAGO, ILL.

22½V. "B" Storage Battery

ABSOLUTELY FOOLPROOF—Complete with instructions *ready to charge at home.* Cannot be harmed by overcharging or overdischarging. Plates will not buckle. *An ideal battery* — endorsed by hundreds of satisfied users.

SEND NO MONEY

Simply mail us your name, and we will send you a battery, pay postman upon arrival: **$3.98** Plus postage. IF NOT SATISFIED—MONEY BACK.

CO-OPERATIVE MERCHANDISE COMPANY
Dept. 211 Chelsea, Mass

Band Saw with Motor Only $104

A rare bargain in a 14-inch Band Saw. Staunchly built and carrying the Boice-Crane guarantee of satisfaction. 35" high. Table, 12"x14", tilts to 35 degrees. Guides accommodate blades ⅛ to ½ inch. Maximum distance between table and upper guide, 6". Complete with ⅛ h. p. ball bearing motor **$104.** Without motor **$65.**

Sold on Money Back Guarantee

Write for descriptive catalog including Bench Saws and Jointers.

W. & J. BOICE Dept. D-12 Toledo, Ohio

How to Build ULTRADYNE
The Improved SUPER-HETERODYNE

32-page illustrated book with detailed instructions on drilling, wiring, assembling and operating Model L-2 Ultradyne Receiver. Latest authentic edition by R. E. Lacault, A.M.I.R.E., inventor of the Ultradyne, the most selective receiver known.

Write for Descriptive Circular.

PHENIX RADIO CORP.
3 Beekman St., N. Y.

50

Have you begun collecting EKKO *Broadcasting Station Stamps?*

See your radio dealer or write to us.

The EKKO COMPANY
111 West Monroe St., CHICAGO

Built to provide loud speaker entertainment from stations vast distances off—even while nearby stations are sending.

—the gift the whole family will enjoy

—costs only $75

The Marvelous MIRACO Ultra 5

[FIVE TUBE OUTFIT IN BEAUTIFUL SOLID MAHOGANY CASE]

Unsurpassed selectivity, sensitivity, range, volume and tone combined

A beautiful sweet toned, five tube, "coast to coast" loud speaker set—factory-built, factory-tested and factory-guaranteed by one of America's oldest and most reliable manufacturers of quality sets. Composed of the finest parts obtainable. Equipped with the latest improvements, refinements and features found on costliest sets. Encased in a handsome hand-rubbed **solid mahogany** cabinet. Looks and performs like $200 set.

Thoroughly tested and approved by radio's highest authorities. **For only $75—a price which has rocked the industry!** Unquestionably the most astounding value offered radio lovers.

Simple to connect and operate. No experience necessary.

Even a beginner can quickly learn to cut through the locals, get far-off programs loud and clear on the speaker, log all stations and bring them back at will. Full directions with each set.

The Miraco **"Ultra 5"** is non-radiating, non-howling, non-distorting. Has cut-out switch—and a first stage phone jack, for tuning—on front of Bakelite panel. Bakelite sub-base under which all wiring is hidden, and other newest features. Operates on storage battery or dry cells.

Other Miraco Long Distance Sets $14.35 up

The Improved Miraco 1925 Model MW—with filament switch, phone jack, etc.—is a four tube outfit that users in every state report outperforms and outdistances sets twice as expensive. Operates loud speaker on distant stations. One stage tuned r.f. amplification, detector, two stages a.f. amplification. Solid mahogany cabinet. Value beyond duplication at **$54.50.**

This wonderful new Miraco Model R-3 is the three-tube, long distance, loud speaker set that has created such a sensation. Easy to tune and log. Covers wave lengths 150 to 625 meters. Detector acts also as a tuned r.f. amplifier. 2 stages a.f. amplification. Has no equal for simplicity, volume, range or clearness at anywhere near its price of **$29.50.**

Miraco Model R justly deserves its title, "Radio's finest low priced quality receiver." One tube acts as a tuned radio frequency amplifier and detector combined. A great distance getter. Easy to operate and log. Covers all wave lengths 150 to 625 meters. Like all Miraco sets, it uses storage battery or dry cells. Never such value before at only **$14.35.**

Send coupon for free bulletins!

or order direct from this ad

All Miraco sets are factory-built, COMPLETELY ASSEMBLED, factory-tested and factory-guaranteed. They may be used with any tubes or batteries.

MIDWEST RADIO CORPORATION, Pioneer Builders of Sets
407-D East Eight Street, Cincinnati, Ohio.

Send free literature and full particulars about your complete line of Miraco products.

( ) Dealer ( ) Jobber ( ) Agent ( ) User

NAME.....

ADDRESS.....

MIRACO RADIO GETS 'EM COAST to COAST

NOTE: Remember that Miraco Tuned Radio Frequency Sets are built and fully guaranteed by a reliable, long established concern, one of the first to build quality sets. Thousands of users endorse their satisfactory performance. Send for further testimony of coast to coast reception and proof that Miraco Sets are radio's finest low-priced receivers.

COLORADO HEARS N.Y. AND CALIFORNIA

I heard New York and California the first night on my Miraco.—Fred Knappenburg, Jr., Burns, Colo.

NEW YORK HEARS ALASKA

Received 115 stations with my Miraco including WLAY Juneau, Alaska, NNW Seattle, KSL San Francisco, FEV Houston, Texas, and CFAC Calgary, Canada.—E. D. Elliott, Milford, N. Y.

OHIO HEARS 12 CITIES THE FIRST NIGHT

The first night we tried out our Miraco we got Atlanta, Philadelphia, Washington, New York, Detroit, Davenport, Omaha, Hastings, Nebr., Chicago, Schenectady, Pittsburgh and Texas. We think that was real good for beginners.—W. L. Musselman, New Carlisle, Ohio.

NORTH DAKOTA HEARS 43 STATIONS FIRST 3 DAYS

Bought a Miraco, operated it three days and received: FGR, WLW, WDAP, KFI, GROM, WJAZ, WMAI, CFAC, WTAM, KYW, KFAX, KLZ, WWJ, WOC, WHA, SPI, KDAK, WBAP, KFIX, PWX, WOS, WHB, KDAF, WHAS, KPI, KFKB, WLAG, WBAH, WHA, KGAL, WEAF, WOAW, WCAE, KGW, WCK, WGY, KSD, WPAM, CKY, WCBD, WTAY. Who has a better record?—W. L. Johnson, Bailey, N. D.

DEALERS, AGENTS

Write for our new proposition. The nation-wide use and popularity of Miraco Sets, their amazingly low prices and the extensive advertising we are doing, makes them wanted everywhere. Send coupon today—good territory open.

$25,000 TO 1,000 MEN
BIG PROFITS TO LIVE RADIO FANS

We have developed a World Beater. A five-tube set that has no equal in simplicity of operation, clarity of tone, range or volume, all of which is attained without critical adjustments or complicated parts.

To enable our agents to make the greatest possible profit, we are selling these sets fully assembled but not wired.

The efficiency of a Radio Set, **no matter how good the parts** or wiring system, is entirely dependent on the correct placement of the parts and arrangement of wires. These details have been carefully worked out in our laboratory, and if you follow our diagrams and blueprints, you cannot go wrong, and our simple but complete instructions make this easy for anyone.

We will train 1,000 Radio Fans in wiring and adjusting our sets to fit them to act as our agents and representatives, and handle the rush of business that is bound to come from the quality of our product and the volume and character of our advertising.

The Retail Price of the Blue Seal set as above described with engraved panel, and a beautiful cabinet, is $90.00.

To those able to devote all or part of their time to the sale of Blue Seal sets, we offer a liberal agent's discount.

In addition to this, an excellent income may be derived from the wiring of these sets for our customers.

We want real HUSTLERS, and while our regular margin of profit and the income derived from wiring the sets sold is very attractive, in order to select and finally make permanent arrangements with the best of our agents we are offering

$25,000.00 IN PREMIUMS AND BONUSES
BASED ON VOLUME OF SALES

WRITE TODAY for illustrated circular and full details which may be the means of putting you in a permanent and profitable business.

If you are not in a position to become our representative, but want the best radio set in your community, we will supply you direct until such time as a local agent is appointed.

BLUE SEAL MANUFACTURING CO.
Dept. 3, 1406-08 South Michigan Ave. Chicago, Ill.

HEAR MUSIC and TALKING 1000 MILES AWAY

New Radio Set Has No Outside Wires or Storage Batteries

The new Trans-continental Radiophone which is the most simple, and the clearest toned radio set you have ever listened to, is the invention of Mr. Coats, of Chicago. This radio outfit is entirely different from all others. No outside wires needed. No troublesome storage batteries. It comes complete, in a beautiful mahogany finish cabinet (console type) and a loud speaker built right in so the entire family can listen to it just like a phonograph. It is guaranteed to have a range of 1,000 miles. Listen to the musical concerts, singing, lectures and speeches. Get the market reports, latest news and sports by radio. Mr. Coats wants to place one of his amazing new radio outfits in each locality and is making a special reduction of 40 per cent for the first outfit placed in each community. Write **Mr. H.N. Coats, 338 W. 47th St., Chicago,** for his special low price offer and be the first in your locality.

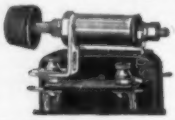
It sells on sight

A two-minute demonstration will sell the nationally advertised **Whisper-It** Mouthpiece wherever a telephone is used. And you make 100% profit on each sale. Unconditional guarantee of satisfaction or money refunded protects you absolutely. Write at once for the ***Whisper-It*** proposition.

P. M. Colytt Laboratories
565 W. Washington Street, Chicago

ELECTRAD

Certified Leaks Absolutely accurately calibrated, permanent fixed resistance units from ¼ to 10 megohms. **Price 50c.**



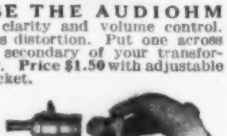
USE THE AUDIOHM for clarity and volume control. Kills distortion. Put one across the secondary of your transformer. **Price $1.50** with adjustable bracket.

GET Clear, Distortionless Reception. Distortion, weak signals, lost signals are almost always caused by inferior small parts. Protect yourself from disappointment, insure getting

Distance, Clarity and Volume

By using Electrad radio parts. Money back guarantee they will improve your set.

Electrad Parts on sale at reliable radio stores. Sold direct if dealer cannot supply you.



LAMP SOCKET ANTENNA Just plug in on any electric light line; no need of outdoor or indoor aerials. Simplest, neatest, most efficient in market. **Price 75c.**

INDORARIAL Hang or lay anywhere, roll up when not in use. Wonderful directional effects, cuts out local stations. Use as ground. **Price $1.50.**

VARIOHM A variable grid leak. Will give you exactly the correct grid resistance. Any resistance from ¼ to 30 megohms. Made to fit standard Dubilier Condenser. Once set is permanent. **Price $1.25.**

ELECTRAD Inc.
428 Broadway, New York

SOLDERALL
METAL IN PASTE FORM

Every Electrical Connection needs Solderall for perfect reception **25¢**

The SOLDERALL CO., NEWARK, N.J.

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MAKE $100 WEEKLY — NEW WAY

To Get **COMPLETE RADIO FREE** Sells for **$15.90**

Get this complete radio genuine vacuum tube receiving set complete, direct from factory. Wired ready to operate. Demonstrate its long range receiving powers—amazing results. Makes quick sales. Get yours for nothing with big commissions. Comes complete with panel, cabinet, dials, low loss condensers, coils, rheostat, jack, head-phones, battery, supertron tube, aerial. Receiving set **$15.90**—complete with accessories **$23.90.** Make big money demonstrating these sets. Write for free details and selling plan. To get set Send No Money—just name and address, stating whether you want just receiving set or one complete with accessories. Pay Postman amount on arrival. Money back if not satisfied. Write quick—be first in your locality. Rush name and address.

STANDARD RADIO COMPANY
921 Broadway, Dept. P. M. 12, New York, N. Y.

THE NEW "SHACTON" 3-CIRCUIT RECEIVER

Coast to Coast Range, Complete Parts for Building $27.45

SEND NO MONEY

List of Standard Parts

- 1 7x18 Drilled Radion Mahoganite Panel engraved in gold.
- 1 Brunswick Low Loss three-circuit Tuning Coil.
- 1 Genuine Brunswick Low Loss Condenser.
- 1 Brunswick Triploid Mounting Socket and Binding Post Strip.
- 2 Brunswick Cast Foundation Brackets.
- 2 Brunswick Jacks with Gold-plated Fronts; 1 for phones; 1 for loud speaker.
- 1 Freshman Mica Grid Condenser.
- 1 Standard Glass Enclosed Grid Leak.
- 2 30-ohm Shacton Bakelite Rheostats with Gold-plated Indicators.
- 2 Moulded Mahogany Dials grained to match panel.
- 5 Lengths Professional Round Busbar.
- 1 Special Blueprint for this circuit. Not an ordinary hook-up, but a clear picture form that a child can understand and make.

All Assembled Ready to Wire

ACCESSORIES

Everything needed to operate after building is listed here:

3 Type 201-A Tested Tubes	$10.35
1 60-ampere Hour Storage Battery	11.25
2 45-volt Extra Large Enco "B" Batteries	6.50
1 pr. 3000-ohm Head Phones and cord	3.75
1 Phone Plug, Double	.90
1 Antenna Equipment	1.50
Complete Outfit (Parts Also Sold Separately)	$34.25

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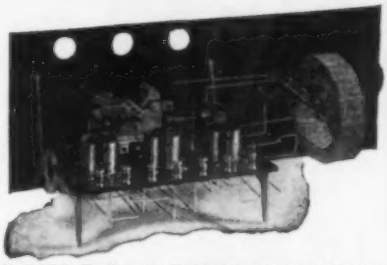
Order Building Kit and Accessory Outfit both together, and we will send Fine Mahogany Finish Cabinet FREE.

ERLA

We carry the most complete stock of Erla parts and Erla factory sealed kits in the country. Send for catalog.



LOW LOSS THROUGHOUT

This receiver maintains two prominent features. Air insulated, with Low Loss Coil, gives you all signal strength possible. The heavy wiring throughout lowers resistance to a minimum and enables fine, sharp tuning.

MAIL THIS COUPON NOW—SEND NO MONEY

RADIO SHACK, Dept. 927, 55 Vesey St., New York, N. Y.

Please send me the new Shacton Three-circuit Receiver I have marked. When it arrives I will pay the postman the amount. If I am not satisfied I will return it in 5 days, and you agree to refund my money instantly. Mark Choice in square.

(A) Complete Building Kit....$27.45 ☐ (B) Operating Outfit.....$34.25 ☐

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$12.98

From Factory to You

Set with Vacuum Tube, all batteries, phones, aerial, ground wire and insulators. Ready to operate, $22.88.

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Not a Crystal Set A real vacuum tube set—**entirely new principle** accounts for greater distance, wonderful tone and ultra-selectivity. No set like BEARCAT. Beautiful mahogany finish cabinet. All batteries fit **inside.** Hear market reports; news every 30 minutes day and night; music, opera, dance orchestras, church services, election returns. Get a BEARCAT now!

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We guarantee our new 68-page RADIO Catalog will save you money

on brand new fully guaranteed, nationally advertised radio apparatus. We buy up manufacturer's and government surplus stocks, jobber and dealer bankrupt stocks, etc. Our enormous buying power permits us to pay spot cash and get rock-bottom prices—even way below manufacturer's costs. That's why our catalog is crammed with thousands of wonderful radio bargains. That's why we GUARANTEE to save you money.

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A NEW and better loud speaker with marked refinements of design and a superlatively finer tone over the entire acoustical range. Reproduces voice and all instruments with a remarkable fidelity.

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Howard Guaranteed Parts

Rheostats, Potentiometers, Sockets, Phone Plugs, Fixed Condensers, Binding Posts, Soldering Lugs, etc.

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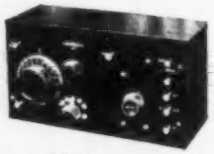

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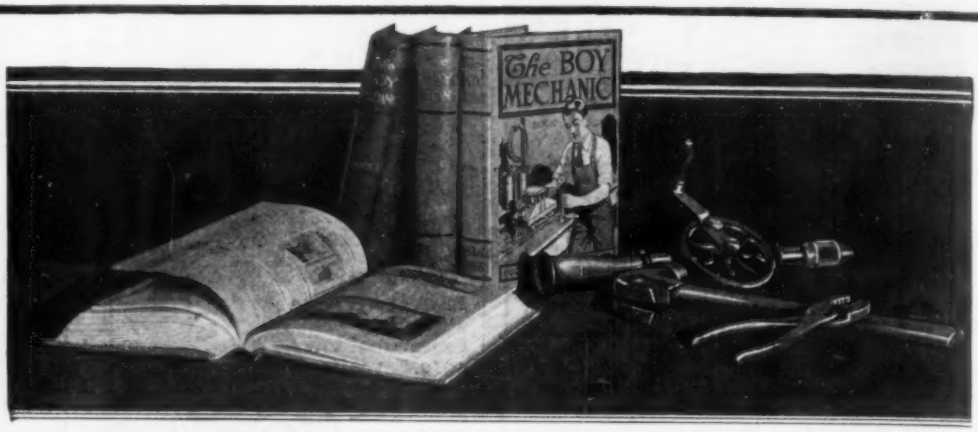

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Generate **High Frequency Violet Ray, Mechanical Vibration, Medical Electricity** and **Ozone**—the four greatest curative agents. Combined or separate. They operate on the electric light in your home or on their own motive power at less than 50 cents per year.

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Says Navy Man "I cannot see," writes Mr. Harold G. Gould, of Northome, Minn., "how such a glass can be sold for anything like the price you ask; $50 would be cheap enough for such a fine instrument."

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By actual test this long range, Naval Officer type binocular equals the best German 10-power instruments selling for over $100. Large field of view with wonderful illumination and definition. Weighs but 20 oz. Central focusing with individual eye-strength and width adjustments. Amazing value. Complete with case and straps, prepaid, for only $27. Guaranteed satisfactory or money returned. 8-power glass similar to above, only $18.50.

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Information on how you can earn $300.00 or more a month will be sent to the first person in each locality who writes. Become our local distributor for a recognized household necessity in rural districts and small towns. Easy work for

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The Famous L.C.Smith Silent Model No. 7

This is the famous L. C. Smith typewriter which has set the world's standard for quality and service for over twenty years. Perfect machines. Standard size. Has the full correspondence keyboard of 76 characters—single shift—universally used in teaching the touch system. The entire line of writing completely visible at all times, has the decimal tabulator, the two color ribbon, with automatic reverse, the back spacer, **ball bearing** type bars, **ball bearing** carriage action, **ball bearing** shift action. Every late style feature and modern operating convenience. Comes to you with everything complete; tools, cover, operating book and instructions—nothing extra to buy. **You cannot imagine the perfection of this beautiful typewriter until you have seen it. We do the most perfect and highest class job of rebuilding known to the typewriter industry. We have sold thousands of these perfect late style machines at this bargain price and every one of these satisfied customers had this splendid, strictly up-to-date machine on ten days' free trial before deciding to buy it.** We will send it to you F. O. B. Chicago for ten days' free trial. It will sell itself, but if you are not satisfied that this is the greatest typewriter you ever saw, you can return it at our expense. You won't want to return it after you try it, for you cannot equal this wonderful value anywhere.

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500—25c pkgs. at 9c cost you $45.00—sell for $125.00—your profit $80.00

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Fine Xmas Gift!

Entirely hand made in Spain. Genuine brown Morocco. Highest quality. Holds one package cigarettes. Sent prepaid for $1 to introduce exclusive line of hand sewn Spanish leather.

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These books contain 1,023 ideas for auto repairing and shop work. They tell how to make special tools, and fixtures.

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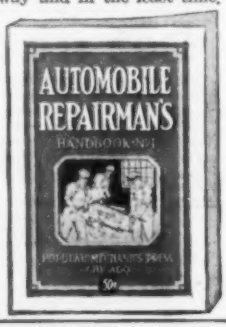

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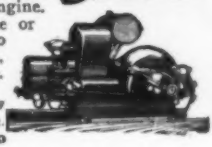

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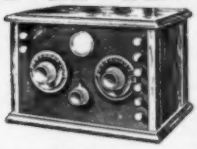

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Arthur Sollee of S. Jacksonville, Fla., says: "I made 41 miles off a gallon." Chas. Luetzen of New Holstein, Wis., says: "I made 11 miles on a quart of gas on one test, and 35 miles with three quarts of gas." Dewey S. Kagg of New Boston says: "I made 44 miles on a gallon of gas."

It is automatic and self-regulating and can be attached by anyone to any car in a few minutes.

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Clear, white bond paper, with envelopes to match. Your name and address printed in beautiful, rich blue ink, on both paper and envelopes, and sent to you postpaid for only $1. (West of Mississippi River and outside of U. S. $1.10.) If inconvenient to send the money, we will ship C. O. D. Money returned if you are not more than satisfied. Order today. *Write name and address plainly.*

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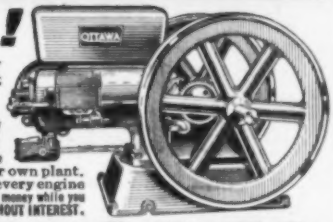
Never before has any farm or shop engine manufacturer made a bona fide no-money down offer on his engines. We are **daring** to make such an offer because we know what OTTAWA Engines will do. We want you to prove to yourself that the OTTAWA is the easiest engine to start; uses less fuel and does more work per h-p. than any other engine you ever saw.



NOT A CENT DOWN Your request that you would like to try this engine is all we ask. You do not send a penny down—you have no papers to sign. After you have tried the engine right at your own work for full THIRTY DAYS, then send us the small payment of $4.95 a month.

DIRECT FROM FACTORY We don't buy our engines from someone else and then sell them to you. We build them in our own plant. We know just what goes into them and we test every engine three times before you receive it. You keep your money while you test it. Then pay for it in SMALL MONTHLY PAYMENTS, WITHOUT INTEREST.

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$4.95 MONTHLY

Smallest monthly payment ever made on a 1½ H-P. engine—other sizes 2¼ to 22 H-P. at proportionally low monthly payments—a whole year to pay if you want. **No interest; no C.O.D.; no mortgages to sign.** Get full information, now.

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Run on kerosene or gasoline without changing. New patented Venturi makes the OTTAWA easier to start. Throttling governor, WICO Magneto ignition. Thousands upon thousands of shopmen and farmers will only use the OTTAWA. It is the most reliable engine and will last longer. Investigate it now before you try any others. It costs you nothing to test it 30 days.

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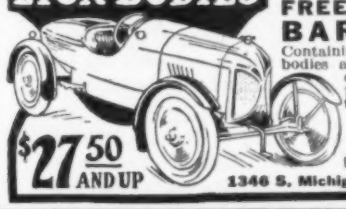

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OXO-GAS oil burner for ranges One of 20 types for all purposes.

OXO-GAS, the cheapest, cleanest, most efficient fuel known to science is made from kerosene or distillate, and air, mostly air. Burns with a pure blue flame of high heating intensity, as silently as city gas. *Over a million in use.* Manufactured by the oldest (est. 1906), highest rated and most responsible corporation. *Ask any bank.*

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Radio That Satisfies the *Music Critic*

THE
CHICAGO DAILY NEWS
EDITORIAL ROOMS

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Rauland Manufacturing Co.,
2650 Coyne Street., Chicago, Ill.

My dear Mr. Rauland:

I want to express my great pleasure in witnessing the recent test of amplifying transformers in your laboratory, and in selecting, from different instruments tested, the one which seemed to me to reproduce most exactly the artist's original tones. I was indeed gratified to learn, after the tests, that the instrument which I had repeatedly selected as by far the most successful in reproducing, not alone the music, but even the very personality of the artist, was none other than your own new "Rauland-Lyric" Transformer.

I feel confident that music lovers everywhere will appreciate the contribution you have made to their enjoyment in the creation of this reproducing instrument.

Very truly yours,
Music Critic, Maurice Rosenfeld
Chicago Daily News

In placing his mark of approval upon Rauland-Lyric, Mr. Maurice Rosenfeld has invested Radio with a new beauty and dignity.

You can have, in your home, the amplifying instrument which has been commended by eminent critics. Rauland-Lyric can be installed in your present set, or one that you may buy, to replace any ordinary audio transformer.

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Rauland-Lyric
AN
ALL-AMERICAN
TRADE MARK
TRANSFORMER

What I Learned About Old Age

By Byron C. Kelley, A.M., LL.D.

I recently had the most startling disclosure of my life on the subject of old age. I am approaching 40 years old myself. I had begun to wonder if I would soon begin to "break"—to lose my old-time pep and aggressiveness, my stamina and resistance against diseases, like most other men of this age. I wondered if I would soon be subject to the class of ailments which seem so prevalent among men past 40. Then, through a mutual friend, I made the acquaintance of a certain scientist, a member of the American Association for the Advancement of Science, who has recently brought to light most interesting facts about the peculiar conditions common to men past middle age.

65% Have Gland Trouble

I learned that 65% of all men past a certain middle age have a disorder of a little gland, called the Prostate. And prostate disorder not only is the direct cause of much distress, often necessitating operation, but it displays itself in many parts of the body.

Common Middle Age Ailments

Here is an important cause for many ailments which heretofore have been simply ascribed as "old age" symptoms—sciatica, aches in back, legs, and feet, frequently nightly risings, nervousness and irritability, often go along with it. And I learned how, by an astonishingly simple new method, that these disorders could be eliminated in a short time without drugs or operation—by an amazing new treatment that reaches this gland directly—yet is so convenient that anyone can apply it in their own home.

10,000 Men Find Relief

But most surprising of all, I found that 10,000 men have already found relief through this amazing discovery. Statesmen, bankers, lawyers, doctors in every section of the country are using and endorsing the method. And it is within the reach of every one. There are no drugs, no books, no electric rays.

Explained in FREE Book

If you are troubled with any of the disorders mentioned, if you have chronic constipation or Prostate trouble, you should learn the facts about this discovery at once. A vitally interesting book written by this scientist called "Why Many Men Are Old at 40," will be sent free if you request it at once. It describes this splendid treatment and shows how you may regain much of your youthful vigor and be free from certain disorders. No obligation. But write at once—the edition is limited. Simply mail request to The Electro Thermal Company, 2140 Main Street, Steubenville, Ohio, the concern that is distributing these books for the author.

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The *Baby Grand* Lathe

A sturdy, practical lathe of small size, high quality and at low price. Operation same as large lathes. Made of selected materials by skilled machinists who specialize on lathe building. Quantity production explains the low price. Not a toy but a practical machine for all small work. Hundreds in use in shops large and small the country over. Sold direct from factory to you on positive money-back guarantee. We also make Bench Drills and Grinders.

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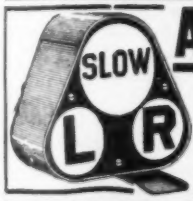

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The MERCURY Edgemaker

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E-1—Complete with blade holder for all safety blades. Regular price, $1.75	1.25
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An Iver Johnson Bicycle

Just what brother or sister wants! Made to fit all sizes of men, women, boys and girls. Built with the famous Truss Bridge Frame, or Drop Bar if desired.

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Champion Single Barrel Shot Guns in various gauges and styles including the Matted Top Rib and the .410. Also Double Barrel Hammerless Shot Guns.

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Loads of safe fun for any little boy or girl. Made in three sizes, with brilliant baked-on enamel finish, either red or blue, with white head; full nickel fork; all nickel plating over copper.

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DEALERS: We sell Bicycles and Velocipedes direct to retailers. A golden opportunity is yours to handle this famous line. Write for DEALER PLAN.

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Make Your Watches, Clocks, Etc., Visible by Night The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, **emits rays of white light,** rendering it **perfectly visible** in the dark. **THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES.** Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Small bottle, **price 25c.** Larger sizes, **50c** and **$1** postpaid.

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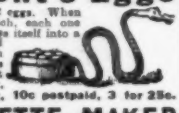
Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most life-like manner.



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Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs ½ oz. Made entirely of metal, nickel-plated. **Price 25c postpaid.**

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GREAT CURIOSITY Smallest Bible in the World. Size of a postage stamp. **200 Pages.** Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. PRICE **15c** each. **3** for **40c, 12** for **$1.35, 100** for **$7.50. Magnifying Glass** for use with Midget Bible, **15c.**

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With a bunch of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. **Prices, postpaid: 25 Bills 15c, 50 Bills 25c, 125 for 50c, or $3.50 thousand.**

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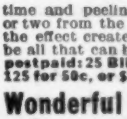

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your fingers, the lead in a lead pencil, the interior opening in a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. Price **10c, 3** for **25c, 1** dozen **75c. Johnson Smith & Co.**

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Quaint and Novel Design

A VERY striking and uncommon ring. Silver finish, skull and crossbone design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence its name, **Good Luck Ring.** Very unique ring that you will take a pride in wearing. **ONLY 25 CENTS.**

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The most laughable novelty yet produced. Made of rubber, and you have only to blow it up and stand the pig on his feet, when he begins to squeal as he slowly collapses and finally lies down and dies in the most natural manner. You can blow him up as often as desired, and each time he will go through the same performance to the great amusement and delight of your friends. Price, **15 cents; 3** for **40** cents; one dozen **$1.35,** mailed.

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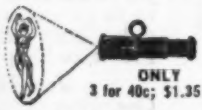

15c

ONLY 3 for 40c; $1.35 doz.

Very pretty little curiosities and decidedly novel. Fitted with Magnifying Lenses that enlarge the pictures to a very surprising degree; in fact, it seems almost incredible that a clear picture could be possible in such a small compass, and how sharp and distinct they show up when you look through. Come in assorted views—Actresses, views of Panama Canal, Lord's Prayer in type, etc.

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A jointed figure of a skeleton 14 in. in height, will dance to music and perform various gyrations and movements while the operator may be some distance from it.

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Useful Knots, Hitches, Splices, etc.

A most practical handbook giving complete and simple directions for making all the most useful knots, hitches, rigging, splices, etc. Over 100 illustrations. All about wire rope attachments, lashing, blocks, tackles, etc. 37 Heraldic Knots illustrated. Of great value to mechanics, riggers, campers, boatmen. **Price 20c ppd.**

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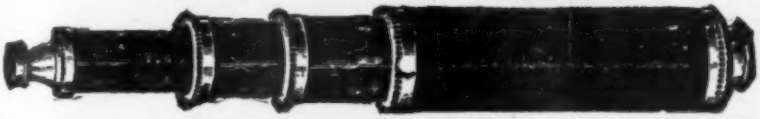
AND MICROSCOPE COMBINED



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Guaranteed SCIENTIFICALLY PERFECT by the Makers

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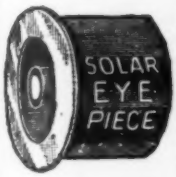

The New Excelsior Solar Telescope is a large, powerful and serviceable instrument, well made and accurately fitted, and marvelously cheap. A Telescope with an **Adjustable Solar Eyepiece** for observing Eclipses of the Sun and examining the very interesting and mysterious Sun Spots, has never before been obtainable for less than several times the price charged; in fact, such an eyepiece alone usually costs more than the price charged for this complete Telescope. The lenses are well ground and adjusted, and the **five sections** are perfectly fitted. There is a metallic cap to protect the object glass from injury and to exclude dust. The section with the eye piece can be withdrawn and used separately as a powerful **magnifier** or **microscope.** The Telescope when fully extended is about 3 feet 6 inches in length, and when closed it measures almost a foot. Tourists, residents at the seaside, farmers and others able to enjoy wide and extended views should have this excellent and wonderfully cheap Telescope. For a limited time only we are offering this Telescope, complete, postpaid, at the very remarkably low price of... **Only $1.85**

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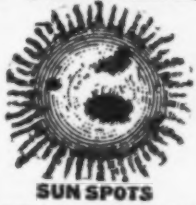

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MYSTERY BOAT Runs for hours without mechanism of any kind. Speed Record 9 miles an hour. Kicks up water and sounds like real motor boat. Entirely new and patented principle never before applied to toys. Just place a small lump of Canned Heat such as Sterno, obtainable anywhere, in boat and light. Costs only **One Tenth of a Cent for One Charge.** Runs wherever there is water—in a bath-tub, dishpan—anywhere at all. Any child can operate it. Made entirely of metal, attractively enameled in colors, hull dark green and deck bright red. Indestructible, fool-proof and safe, 9 inches long. **Price $1.00. CANNED HEAT, 20c per can. JOHNSON SMITH & CO., Dept. 278, Racine, Wis.**

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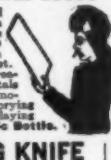

The most confidential messages can be written with this Ink, for the writing **MAKES NO MARK.** Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your postals and other private memorandums away from prying eyes. Great fun for playing practical jokes. **Only 15c Bottle.**

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Writing written with this remarkable ink vanishes entirely in a few weeks (sooner if desired), leaving the paper QUITE BLANK. **15c pad.**

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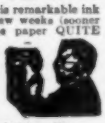

writing can be READ ONLY IN A DARK ROOM; writing **shines like fire.** Quite invisible at daytime. Very remarkable. **15c.**

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Latest novelty, a good substantial knife made by a first-class cutlery establishment for 15c. Knife is perfect imitation of lady's leg with embossed stocking and shoe. **15c postpaid.**

Pencil with Microscopic View

Decidedly novel and excellent pencil with eraser, into which is fitted a tiny microscopic picture, magnified to an almost incredible degree by the small but powerful lens. A great curiosity. Assorted Views: Bathing Girls, Actresses, Panama Canal, Lord's Prayer, etc. **Price 15c.** 3 for 40c., $1.35 doz., postpaid.

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The most wonderful and ingenious Camera made It is but little larger than a watch, which it closely resembles. You can carry the **Expo** about in your pocket and take pictures without any one being the wiser.

Less Than 2 Cents a Picture

The Expo loads in daylight with 18 or 20 Exposure Films, costing 25c and 35c respectively, and thus the picture taking part of a whole day's outing may be had for a very nominal sum — Little more than one cent a picture.

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It is simplicity itself to operate. Takes pictures through the stem, where the **Rapid Fire Lens** is located. The photos (5-8x7-8) may be enlarged to any size. Time and instantaneous shutters; weighs but 3 ounces; nickel plated. Endorsed

Operated as Quick as a Flash by amateurs and professionals the world over. Thoroughly practical—printing and developing of films just the same as ordinary cameras—in daily use by the police, newspaper reporters, detectives, and the general public. Important beats have been secured with the Watch Camera by enterprising reporters. Produces clear, sharp negatives indoors or outdoors equal to any camera on the market, size or price notwithstanding. **Sold Under a Positive Guarantee.**

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Everything about the **Ku Klux Klan** told in a clear, fearless manner. Book tells all—How it started and was suppressed in 1871—The New Ku Klux Klan—How organized—How members are enrolled—Oath of the Klan—**Questions for Candidates**—Creed—Objects of the Order—Obedience—Fidelity—Pledge of Loyalty—**Ku Klux Klan and the Masons**—The Jews—The Masons—Real K. of C. Oath—The Negro Ku Klux Klan, etc., etc. Latest and most complete book on the Klan published. **Price, 35c,** postpaid.

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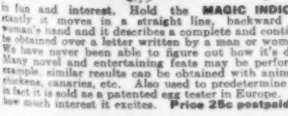
NEW Combines (1) **Moving Picture Machine;** (2) **Magic Lantern;** (3) **Flashlight.** All in one. No gas; no oil. A splendid Moving Picture Machine, using standard Films same as shown at theatres. Shows large, clear pictures. Always ready for use; simply press the flashlight switch and you are ready for the show. Not necessary to have electricity in house. Flashlight can be disconnected and used separately if desired. The mechanism is arranged for use either with Films or Lantern Slides. Given **FREE** with each machine: 1 can Film, 1 Film Compartment Slide (for making your own lantern slides out of old film), 1 Transparent Announcement Slide, and generous supply of admission tickets, badges, guarantee, instructions, etc., carefully packed and sent prepaid to any address for **only $5.50**

Extra Film in 25, 50 or 100 ft. lengths at 1 cent per foot.

JOHNSON SMITH & CO., Dept. 278, Racine, Wis.

SEX INDICATOR



Some time ago we received from abroad what we consider the most unique and entertaining novelty we have ever seen. It's the **MAGIC INDICATOR.** We paid 50 cents for the one we received about a year ago, and we don't believe we ever got a bigger value in fun and interest. Hold the **MAGIC INDICATOR** over a man's hand—instantly it moves in a straight line, backward and forward. Hold it over a woman's hand and it describes a complete and continuous circle. The same action can be obtained over a letter written by a man or woman, etc. It is fascinating; baffling. We have never been able to figure out how it's done—but we've never seen it fail. Many novel and entertaining feats may be performed with the Sex Indicator. For example, similar results can be obtained with animals, cats, dogs, rabbits, over birds, chickens, canaries, etc. Also used to predetermine the sex of chickens and birds, etc., in fact it is sold as a patented egg tester in Europe. Take one to any gathering and see how much interest it excites. **Price 25c postpaid, or 3 for 65c, postpaid.**

All the Latest Surprising and Joke Novelties

Miniature Water Pistol	10c
Cleopatra's Snake (very lifelike)	15c
False Mustache	10c
Pocket Detective (see behind you)	15c
Great Mind Reading Mystery	10c
Thurston's Mysterious Trick Cards	10c
Fighting Roosters, pair	10c
Squirt Ring . 20c Trick Pencil	15c
Rubber Tacks (a good joke)	10c
Mesmerized Penny	30c
Cachoo! Sneezing Powder	10c
Magic Plate Lifter	25c
Imitation Gold Teeth . 3 for	10c
Barking Dog (imitates dog bark)	20c
Exploding Cigarettes, Per Box	25c
26-piece Set Silveroid Tableware	$1.95
"Manos" Self-filling Fountain Pen	25c
Great Fire-eating Trick	30c
Magic Ball and Vase Trick	20c
Naked Truth Joke (Magic Card)	15c
Chicken Inspector Badge	10c
Liar's License . 10c Booze License	10c
Famous Simplex Typewriter	$2.50
250-shot Automatic Cap Pistol	15c
Surprise Matches, per box	10c
Deck Marked Cards	$1.00
Everlasting Writing Pad	15c
Wire Puzzles, big asst. 10c, 3 for	25c
Chimmie Dancer, 15c. Boot Card	6c
Fortune Telling Cards, per deck	25c
3-Reel Moving Picture Machine	$3.00
Air Plant, novel and decorative	25c

All articles listed on above and previous page obtainable from JOHNSON SMITH & CO. Dept. 278, Racine, Wis.

FOR HOMES-SMALL BUILDINGS-FLATS

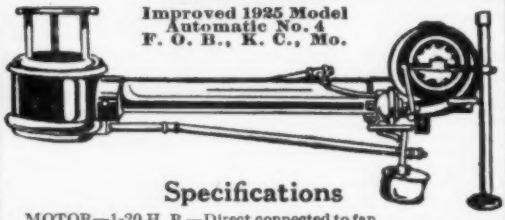
BURNER AND THERMOSTAT $190

ROYAL OIL BURNER

BURNER $150 ONLY

AUTOMATIC

Improved 1925 Model
Automatic No. 4
F. O. B., K. C., Mo.



Specifications

MOTOR—1-20 H. P.—Direct connected to fan.
CAPACITY—Steam radiation—700 sq. ft. Water radiation —1100 sq. ft. Furnace—up to 4 sq. ft. grate.
FUEL—Any gasoil—distillate or kerosene — 36 gravity or higher.
FEED—Gravity flow to burner.
PILOT—Oil pilot fire automatically increased to high fire by thermostat. City gas not required.
WEIGHT—Boxed for shipment—150 lbs. Tanks not included.

Can be installed by any pipe fitter—complete instructions furnished—made in three sizes—Nos. 2, 4 and 5. Dealers in many cities.

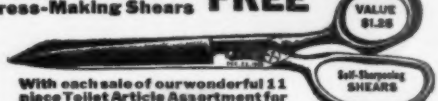
Write for catalog. Some territory still open for exclusive dealers. Oil burner firms will find the Royal a quick selling, dependable addition to their line. We refer to Dun or Bradstreet or any Kansas City bank.

Willis W. Howe Co., *Manufacturers*
3030 McGee Trafficway, Kansas City, Mo.

YOU CAN MAKE $18 DAILY PROFIT

With Our Great Introductory Offer

Giving These $1.25 Dress-Making Shears FREE



With each sale of our wonderful 11 piece Toilet Article Assortment for only $1.75. TOTAL STORE VALUE $4.60

$18.00 a Day PROFIT on only TWENTY Sales

Lucky 11 Toilet Set—Retail Value $3.35!

MY! HOW THEY SELL!

You get the attention with the free Shears. Walter Harris sold 800 boxes in six weeks. Profit over $100 a week. You can do this too.

Act Now! Sell like hot cakes year round. A baby could sell Lucky 11. Don't wait a minute. Save time. Send $1.75 for complete outfit including display case. At least write for circulars explaining our **unique plans**, including 30 other packages. **ACT NOW!**

E. M. DAVIS CO., Dept. 5624, CHICAGO, ILL.

"Been on a vacation Bill?"

"No, Jim—I've stopped smoking. Gained six pounds in a week. You know how I used to smoke—a package of cigarettes and a cigar or two a day—it sure had some hold on me. But I'm cured—took a scientific home tobacco treatment—fixed me up in two weeks.

"Wasn't hard on me at all—noticed improvement the first day—I feel like a new man. It didn't interfere with my work—didn't leave any druggish after-effects—the money I saved in the last two weeks has paid for the treatment alone.

"Why don't you take it? It has cured men like you and me for over forty years—it is a doctor's individual prescription that sure fixes you up. Just send the coupon for full information NOW. No obligation. All correspondence is strictly confidential."

The Keeley Institute, Dwight, Ill.

Please send me, without any obligation on my part, your free booklet which will tell me how to rid myself of the tobacco habit.

Name.....

Town.....

Street..... State..... P.M.'16

PHILMOR QUALITY SHIRTS PAY BIG PROFITS

THE unusual beauty, fine quality and popular prices of PHILMOR cut-to-fit shirts make them the **fastest selling money-maker** for agents today. Undersell stores. **Quick deliveries.** 300 handsome samples. Steady year-around business. No investment or experience required.

Write today and learn how to get **agent's sample shirt free.**

PHILMOR CO., Dept. B
3 Union Square, New York City

Our BUREAU OF INFORMATION will answer all questions regarding articles in this magazine. Address Popular Mechanics Magazine, Chicago.

"Lighting Fixtures"

READY TO HANG
(Direct from Manufacturer)

Completely wired, including glassware. Send for Catalogue No. 26. Just Off the Press.

Special proposition to DEALERS.

ERIE FIXTURE SUPPLY CO.
STA. A ERIE, PA.

Carrying Case **FREE** with Big **3 ft. Telescope**

See people and objects miles away just like they were close; see Moon and Stars as never before. Opens over 3 ft. long, 5 sections, brass bound, powerful lenses. Useful and entertaining. "Could tell color of aeroplane 4 miles away."—Mrs. Yarbough. "Watch my boy arrive at school 2 miles away."—Mrs. Horn. "Read numbers on freight cars mile away, see mountains on moon."—A. C. Palmer. Thousands pleased.

Send No Money Write today; on arrival of Big 3 ft. Wonder Telescope with FREE Carrying Case and Strap pay Postman only $1.85 plus a few pennies postage. **Satisfaction Guaranteed.**

"Have been watching submarines 8 miles off the coast." P. GROSH

FERRY & CO., 3222 N. Halsted St., Dept. 1778, CHICAGO

$250.00 Weekly~Sullivan's Success~Your Opportunity

$2.50 worth of potatoes will make $25.00 worth "Tater-Flakes" Figure your profits!

Snow-white sides, bright nickel trimmings. A thing of beauty.

Less than a year ago Robert Sullivan, Indiana, was a newspaper man. He was looking for an opportunity to make more money—just as you are. Sullivan read a "Tater-Flakes" ad. Investigated, saw the possibilities, and started into this wonderful business. He is averaging **$250.00 clear every week**—in a small town!

"Tater-Flakes" Booming Everywhere

Down south Hoffman & McLeish are running around **$100.00 daily.** Conover, Ind., averages **$50.00 daily** except Saturdays, which average **$100.00.** Frank Berry, Ind., says: "Using 3 barrels of potatoes daily. Have splendid wholesale and retail business. Am supplying 5c and 10c stores." Mrs. Suttleworth, Colo., averages **$20.00** to **$25.00** daily. Charles Schaffer, Wis., operating 5 stores, averaging **more than $500.00 week!**

It's a Wonderful Business

"Tater-Flakes" are a new and different potato chip. Can't be compared to ordinary chip. The "Tater-Flakes" machine slices, cooks, crisps, browns and delivers Flakes entirely automatically. Anyone can easily operate. Bright girl or boy can run machine. Outfit in window attracts attention. Passing public stops and looks. Golden, crisp "Tater-Flakes" with appetizing odor whets appetite and people buy. Retail business thrives from very start. Profits simply great.

Sold in glassine packets, also in bulk. Big money both ways.

A Business You Can Handle

Write quick—get complete details of this wonderful new business. No experience needed. Moderate capital starts you. We give you every assistance—furnish machine, service men, field men, merchandising ideas, etc. All you have to supply is location. You plunge into retail and wholesale business at once. You become member of great "Tater-Flakes" organization. Have opportunity to attend annual gathering of "Tater-Flake" men—an institution national in scope.

QUICK SUCCESS POSSIBLE

The marvelous "Tater-Flakes" machine—the surpassing goodness of "Tater-Flakes"—the **whole-hearted and continued co-operation** of the "Tater-Flakes" organization—makes **quick success possible.** It's your opportunity—the chance you have been watching for—grasp it quickly. Sit down now and write for full particulars. Your territory may be taken if you delay. Address

TATER-FLAKES CORPORATION, Inc.
Dept. 39 20 E. Jackson Blvd., CHICAGO, ILL.

Cal. 30

U.S. ARMY KRAG CARBINES

All carbines have the new model 1898 stocks. The barrels, actions and parts are either new or have been refinished by the Government, and equal to new **$15**

KRAG RIFLES, $12.50 KRAG SPORTING RIFLES, $14.00 CALIBRE 45 SHOT GUNS, $4.50
CALIBRE 45 CARBINES, $3.50 Utility Bags for Bait, Lunches, etc., 40c. Parcel Post Paid

OLIVE DRAB **Wool Breeches** New—in sizes from 32 waist to 40 waist. Strong light weight wool. Made for the Home Guards . . **$1.50** *Parcel Post Extra*

SEND FOR OUR COMPLETE CATALOG
W. STOKES KIRK
1627-PM North 10th St., PHILADELPHIA, PA.

ARMS, CLOTHING and things out of the ordinary

Harris Homes Beautiful

Bungalows — Semi-Bungalows — Cottages — Residences! If you want a real home combining an impressive exterior and comfortable, well planned, homey room arrangement, you must see the latest De Luxe Addition of our latest book of Homes and Building Materials. More than a hundred modern, attractive, livable houses, featuring all that is best in construction—each one an architectural triumph carefully planned and designed by expert architects.

All Harris Homes Beautiful have been built many times with big economy and life-long satisfaction to their owners. They present a perfect combination of approved construction, finest materials, "planned the Harris way" to save from $500.00 to $1,500.00 of your money. Ask for your copy of this free 400-page Building Material Book, No. CB-7, today.

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OF HOMES
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LUMBER
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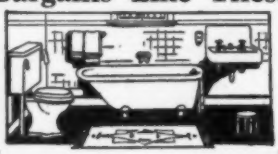
FURNITURE
RUGS
and Every Needed Item to Build, Improve and Furnish Your Home

Thousands of Bargains Like These

Combination Screen and Storm Door. Size 2/8½x7/1, quickly changed, each **$6.77**

2 light 24"x20" glazed, checkrail windows, 1-3/8" thick, outside measure 2/4-1/8x3/10, each **$2.50**



The bathroom outfit shown includes bathtub five feet long, white porcelain enameled on the inside, low pattern white tank closet outfit and white porcelain enameled lavatory complete with all fittings above floor line, special at..... **$65.00**

Clear White Pine Storm Sash with frames, 1-1/8" thick. Best clear glass, each light 8x10. Outside measure 1/9x3/11½, each..... **$1.53**

Economy Special panelled doors, size 2/6x6/6, 1-3/8" thick, each **$3.20**

HARRIS BROTHERS CO.

Dept. CB-7 35th and Iron Streets CHICAGO, ILL.

Ed. H. Witte

Let Me Put You in Business

I have put hundreds of men in the profitable business of cord wood and log sawing. Indications point to a more prosperous season this year. Coal will be high and hard to get. Many farmers and householders in your locality will gladly give you the job of sawing their fuel wood when they learn that you can do the work in one-tenth the time with a

WITTE 3—in—1 SAW RIG

You can cut 60 to 70 cords a day easily. At from 50c to $1.25 a cord, you can readily figure your profits for a day's work. Read what J. S. Johnson of Centralia, Mo., did.

"I sawed 108 beds in 10 hrs. *** best record ever made here. Have been in business 25 yrs. but the WITTE has the ribbon yet for performance."
(Signed)
J. S. Johnson,
Rt. 4,
Centralia, Mo.

You Won't Have to Pay a Cent

out of your present savings. You can make enough money the first 10 days to pay for your outfit. From then on, a clear profit of $100 a week should be easy.

Write Me Today and I will gladly send you details of my plan to put you in a big paying business of your own. **ED. H. WITTE, President**

FREE Be sure to get details and actual pictures in colors of famous Witte Saw Rig. Write today without fail.

WITTE ENGINE WORKS 4742 WITTE BUILDING, KANSAS CITY, MO. 4742 EMPIRE BUILDING, PITTSBURGH, PA.

Popularity *Plus!*

144

The model shown is the new 1924 Alto Buescher Saxophone.

Easy to Play

Easy to Pay

Yours-with this most winning of all musical Instruments

It's easy to be popular - to be in demand socially - to be welcome everywhere - with an irresistible Buescher Saxophone.

Don't be a wall flower. Don't be a dawdler. Step out of the crowd and into the "picture." Be able to do something to earn your welcome. Learn to play a

BUESCHER True Tone SAXOPHONE

Easy? **- you'll be astonished to see what you can do in a few days. Most people are able to play a few pieces of popular music in two or three weeks.**

It's great fun - learning **- and you are mastering an accomplishment that will mean big money to you if you decide to use it commercially.**

Free!

Send the coupon or a postal for a free copy of our very interesting Saxophone Book. Tells all about the various styles with pictures of the famous professionals.

Easy payments to suit your convenience. Six days' free trial. Send the coupon or a postal for your copy of the free Saxophone Book described at left. Mention any other instrument in which you may be interested. No obligation whatever. Do this today.

BUESCHER BAND INSTRUMENT CO.
Everything in Band and Orchestra Instruments
353 Buescher Block Elkhart, Ind.

Buescher Band Instrument Co.
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Gentlemen:
I am interested in Instrument checked below:
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(Mention any other instrument interested in)
Name . . . . . .
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Town State

Everyone interested in Radio should have this

68-page book of approved parts and sets—it's free!

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ONE copy of Ward's New Complete Radio Catalogue is yours Free—you need merely to write for your copy.

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Study this Catalogue every time you need *anything* in Radio, whether parts or a complete set. See what *is the lowest price* for standard quality goods.

Everything shown in this Catalogue has been selected by an expert. Everything is standard. Remember at Ward's we never sacrifice quality to make a low price. Yet our prices are always low because we sell direct to you by mail—and without the usual "Radio Profits."

Bring the Joy of Radio Into Your Home

You can get the most enjoyment out of Radio only by using standard, high grade equipment. You know what you are getting when you buy at Ward's. You are sure of high quality as well as a big saving when you order from this book, for our Radio equipment is sold under the same liberal guarantee we have made for 52 years on every article sold by Ward's—"Satisfaction Guaranteed or Your Money Back."

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ESTABLISHED 1872

Montgomery Ward & Co.

The Oldest Mail Order House is Today the Most Progressive

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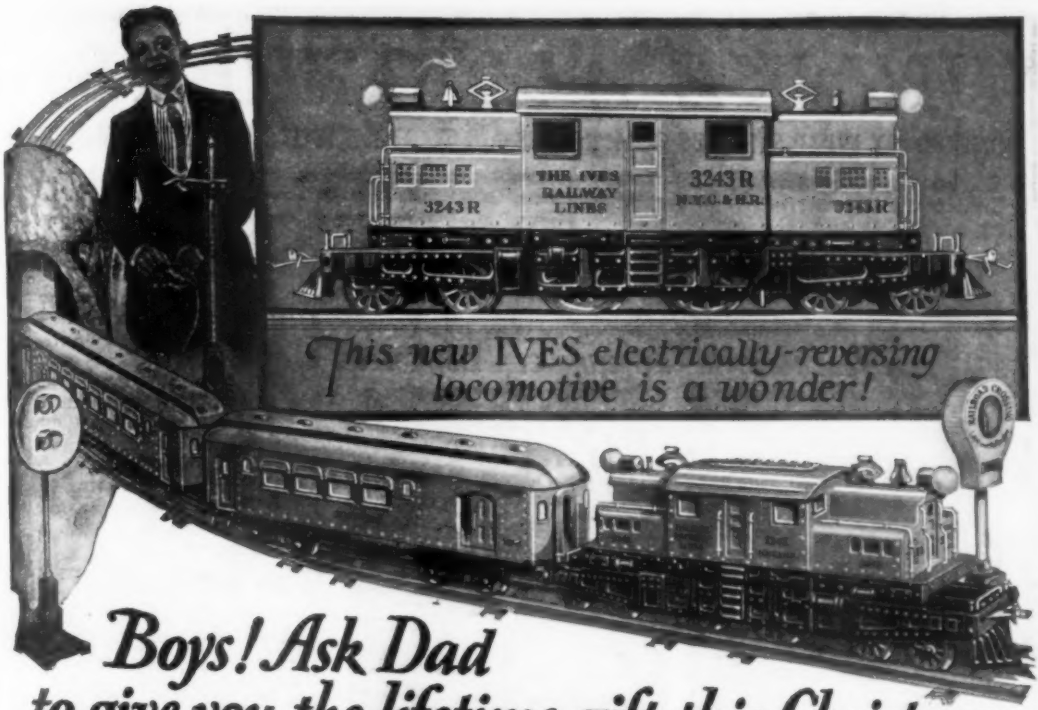


Boys! Ask Dad to give you the lifetime gift this Christmas

—a wonderful Ives Electric Train

You boys will experience one of the greatest joys of your life when you see, on Christmas morning, a wonderful Ives Electric Reversing Locomotive in front of the bright, realistic station. There it stands, waiting for its first run over your newly-established branch of the Ives Railroad System—a system with trackage sufficient to extend from New York to San Francisco, including branch lines all over the country.

Think of a locomotive that is an exact model of the giant electric locomotives used on the New York Central and other great American railroads! A locomotive that will reverse itself, electrically, at any position on the track, without being touched by hand! A locomotive that switches its own cars, shunts them into sidings, or speeds—with electric headlight ablaze and each car illuminated—around the track and couples automatically to the front of the train.

Ives has the most complete railroad system ever devised. There is an unlimited variety of bridges, passenger and freight cars, switches, tunnels, stations, automatic bell signals for crossings, automatic block semaphores, etc.

Ives Toys make happy boys

Ask Dad to give you one of these wonderful Ives Electric Reversing Locomotives this Christmas. There's every conceivable accessory with which to equip a system. Remember, there's an Ives outfit to suit every purse. They include mechanical trains for the boy of 3 years and upward, to the most wonderful, complete electric system. Prices range from $1.50 to $50. At the best toy, department, electrical and hardware stores. Send for brilliantly illustrated 32-page book in full colors which shows the complete Ives line.

Mail this coupon for the Ives book—TODAY!

THE IVES MANUFACTURING CORPORATION
196 Holland Avenue Bridgeport, Conn.

THE IVES MANUFACTURING CORP.
196 Holland Ave. Bridgeport, Conn.

I enclose 10 cents (U. S. Stamps or coin) for your 32-page book in full colors showing the complete line of Ives electric locomotives, freight and passenger cars, signals, etc.

Name.....

Address.....

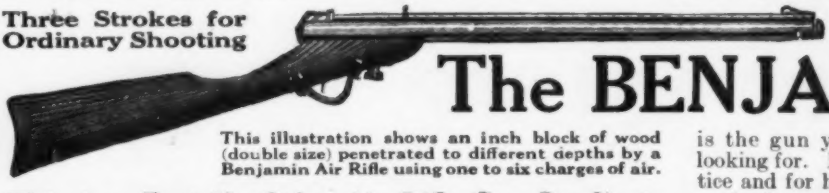
City..... *State*.....

IVES ELECTRIC AND MECHANICAL TRAINS

UNLIKE ALL OTHERS!

ONE TO SIX PUMP-STROKES COMPRESSES AIR TO ANY SHOOTING-FORCE DESIRED

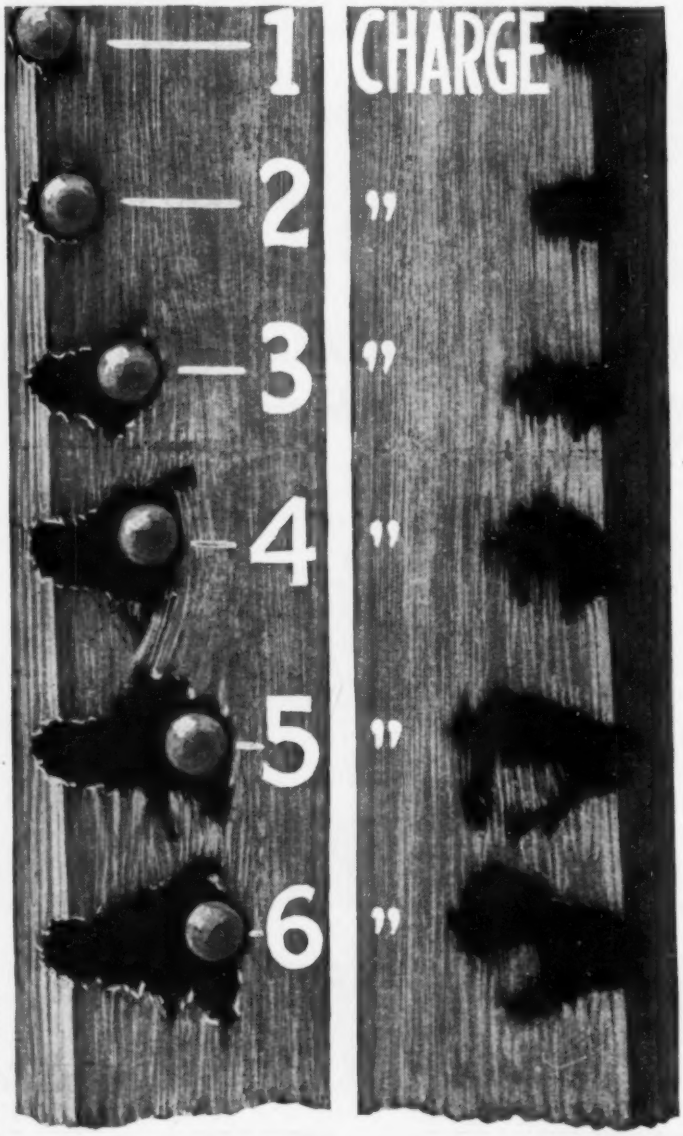
Three Strokes for Ordinary Shooting



The BENJAMIN

This illustration shows an inch block of wood (double size) penetrated to different depths by a Benjamin Air Rifle using one to six charges of air.

This is a Feat No Other Air Rifle Can Duplicate



is the gun you have been looking for. For target practice and for hunting rabbits, squirrels, gophers, rats and frogs it has no equal. It is the most powerful, accurate and reliable compressed air rifle made. It has a far greater shooting range than any other. Imagine bringing down rabbits with an air rifle! You can do it with a Benjamin.

The BENJAMIN

is the ONLY PUMP GUN MADE using compressed air. SIMILAR TO AIR DRILLS AND HAMMERS. It does not lose shooting force after long use. The BENJAMIN is the only air rifle with the shooting force under the operator's control. It can be loaded to shoot weak or powerful as desired, from one to six strokes of the pump giving all the power wanted. It is absolutely safe; accidental discharge is impossible. Furthermore, after being charged with air, it is ready for instant use at any time after the shot is placed in the barrel.

The BENJAMIN

is mechanically perfect. It is the only air rifle not requiring frequent repairs, customary in all spring guns.

Price $5.00 Postpaid

Canvas Case $1.00

Write for descriptive folder giving full details of this wonderful air rifle.

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AIR RIFLE & MFG. CO.
651 N. Broadway
ST. LOUIS, MO., U. S. A.

Pacific Coast Representative
THAYER & BOWER
Los Angeles, Cal. & San Francisco, Cal

60 MILES ON A GALLON OF GASOLINE

TESTS SHOW FORD CAN RUN 60 MILES ON A GALLON

The amazing fact that a Ford can run 60 miles on 1 gallon of gasoline was recently brought to light through tests conducted by America's foremost engineers, where it was shown that a gallon of gasoline contains sufficient heat units which if properly atomized and mixed with air would give this additional mileage. Great strides have already been made in this direction by the recent invention of a simple attachment which can be installed in a few minutes without any alterations to the motor. It is common for Ford Owners to make from 40 to 44 miles per gallon after this marvelous device is attached.

MOST WONDERFUL INVENTION TODAY BRINGS JOY TO FORD OWNERS

Starts Ford Instantly

Starting a Ford Car in cold or zero weather is something every Ford Owner dreads—everybody realizes that difficult starting is an abuse on the starter and battery. Thousands of Ford Cars are "laid up" during the Winter just for these reasons. This great difficulty has been overcome. "The SUPER positively starts a Ford Car instantly in the coldest weather."

Marvelous Device

The SUPER is no trick affair—requires no mechanical adjustments and contains all the scientific principles of carburetors costing $20 to $35 and in its natural action uses up every particle of unused gasoline and breaks it up into a perfect vapor. The hitherto impossible is now realized by the SUPER.

The Heart of the Motor

Everybody Satisfied

Saves 3 to 7 Dollars Per Month

The best investment I ever made. The SUPER is saving me from three to seven dollars each month, besides putting new life into my motor. A. H. WORRA, Iowa.

Makes 44 Miles Per Gallon

I have tried the SUPER and the results of the experiment are satisfactory. One quart of gasoline run my Ford 11 miles over improved roads which is just about again as far as I could run with the plain Ford Carburetor.
G. E. YODER, Penn.

Finds That Our Claims Are Correct

I find that your claims for increased mileage are correct and that a big saving is made by your SUPER, in fact, the best device I have met with in that line.
M. J. VAN LEEUWEN, Mass.

Eliminates Oil Pumping in Front Cylinder

What a wonderful relief to Mr. Ford Owner when he realizes that he can run his car without the motor pumping oil in the front cylinder. Sounds like an awful lot to expect of any device, but that is what the SUPER does and this is only one of its many advantages because it puts real efficiency into any Ford Car.

Complete Combustion

The SUPER is so designed that it takes advantage of the present Ford Carburetor and properly atomizes the light as well as the heavy elements of the fuel, converting every atom of gasoline and kerosene into power preventing liquid fuel from passing into the cylinders, thus avoiding carbon formation and oil dilution.

Easy to Sell

Sells Like Hot Cakes

This is a recent letter from one of our distributors: "Enclosed find draft for 200 more SUPERS, rush as I need them badly. I sold and banked $104.00 in one day. Hope to sell 1000 SUPERS next month."
A. W. LEONARD, Penn.

Making Big Profits Every Noon

I have been working the SUPER at noon only. Yesterday noon I made more money with the SUPER than I did at my 11 hours' hard work in the factory all day. J. L. LEHNER, Wis.

Had No Previous Selling Experience

This letter shows what ambition does: "I sold six SUPERS in less than 2 hours tonight. I think it's a pretty good start—for it's the first thing I ever sold."
E. MANGOLD, Ind.

$60.00 TO $150.00 PER WEEK EASY

You just can't help making Big Money selling the SUPER because a trial sells itself and soon everyone in the neighborhood get talking about this marvelous device. Men like Leonard, Shaw, Manner, Kinsley, Peters, Sands, Beck and Hall are not exceptional salesmen but just the type of men that saw an opportunity and were quick to grasp it when within reach. No previous selling experience is necessary, just a little ambition on your part to make money is all we ask and we will extend the same opportunity to you. Spare time will pay you well. If you can devote your entire time so much the better, because the SUPER is a whirl-wind seller and takes hold in a locality like wildfire.

Men Wanted Everywhere To Introduce

We want distributors in all parts of the country to take orders and deliver the SUPER and to look after the repeat business that is bound to follow and to such distributors we are willing to assign territory. You do not have to own a Ford to take up this proposition but if you have a Ford it is easier to explain its many advantages. However a Trial of the SUPER convinces the most doubtful person and tells a wonderful story.

A REAL FUTURE HERE

WEEKS SUPER CARBURETOR CO.
1304-725 Fond Du Lac Ave., Milwaukee, Wis.

MAIL TODAY

WEEKS SUPER CARBURETOR CO.
1304-725 Fond Du Lac Ave., Milwaukee, Wis.

GENTLEMEN:
Please mail me full free particulars about your wonderful invention.

Name.....
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The table measures 11½ x 3⅜ inches and can be fed three ways by hand wheels. Feed screws have graduations for fine adjustment. Knee is elevated by a screw operated by a hand wheel at back of frame. Bench space of pan or bed, 8 x 12 inches.

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Receiver and Loud Speaker in Combination Cabinet of Solid mahogany

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Complete with all accessories

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That is the remarkable offer we are prepared to make you. Two weeks to prove that the outfit you select is everything we have said for it. If it doesn't make good our claims, back it comes, and your deposit will be cheerfully refunded. But if it fulfills all your expectations, you may pay for it in easy monthly installments. You don't risk a cent when ordering from us. You *must* be satisfied, or we don't do business.

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Beautiful Solid Mahogany Combination

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Please send me your special offer price, terms and full description of Marshall Radio Outfits. Though I may change my mind on receiving your proposition, my preference now is for a:

.....3 Tube .....4 Tube .....5 Tube (Please check)

Name .....

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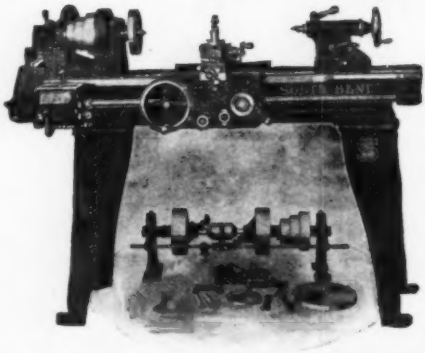
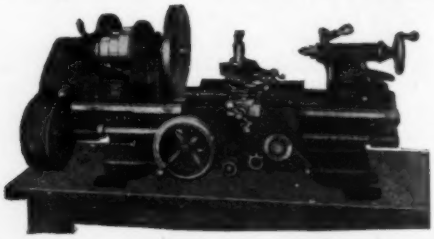
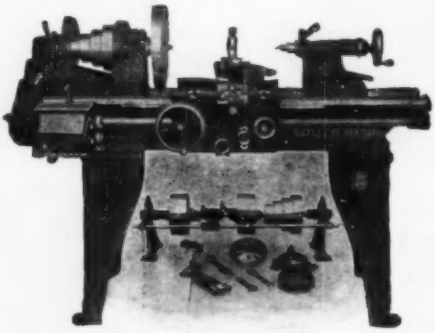


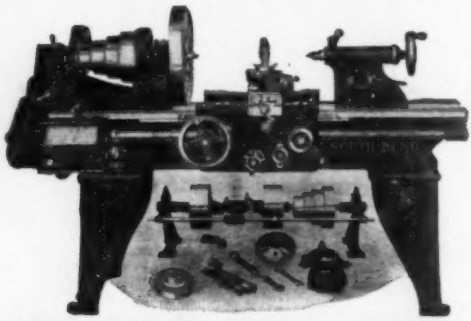
11"x4' Standard Change Gear.....$248.00
11"x4' Quick Change Gear..... 288.00



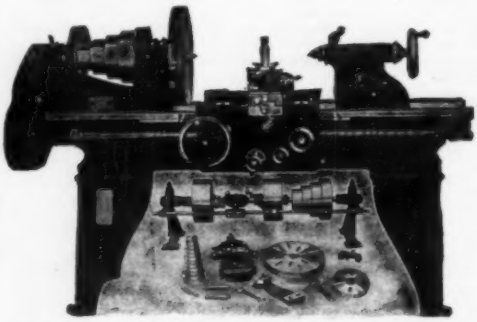
9"x3' Bench, Standard Change Gear....$201.00
9"x3' Bench, Quick Change Gear..... 231.00



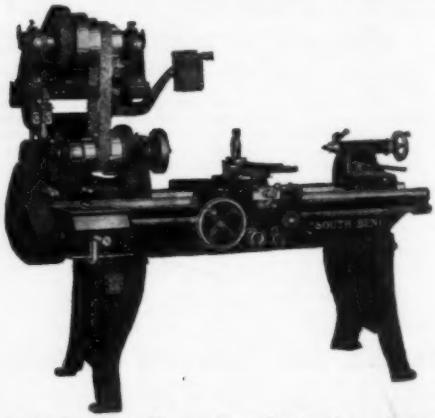
13"x6' Standard Change Gear $316.00
13"x6' Quick Change Gear..... 366.00



18"x10' Standard Change Gear..... $656.00
18"x10' Quick Change Gear 721.00



16"x8' Standard Change Gear.....$438.00
16"x8' Quick Change Gear..... 498.00



16"x8' Standard Change Gear Motor Drive $594.00
16"x8' Quick Change Gear Motor Drive 654.00

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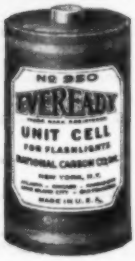

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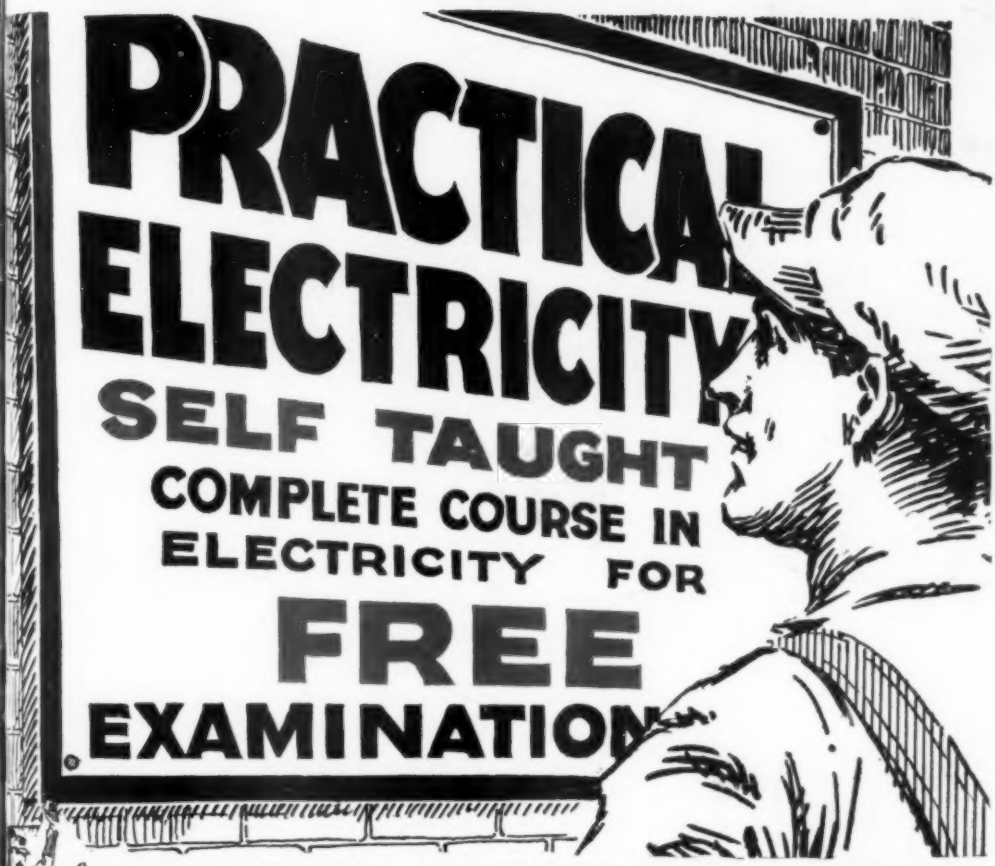

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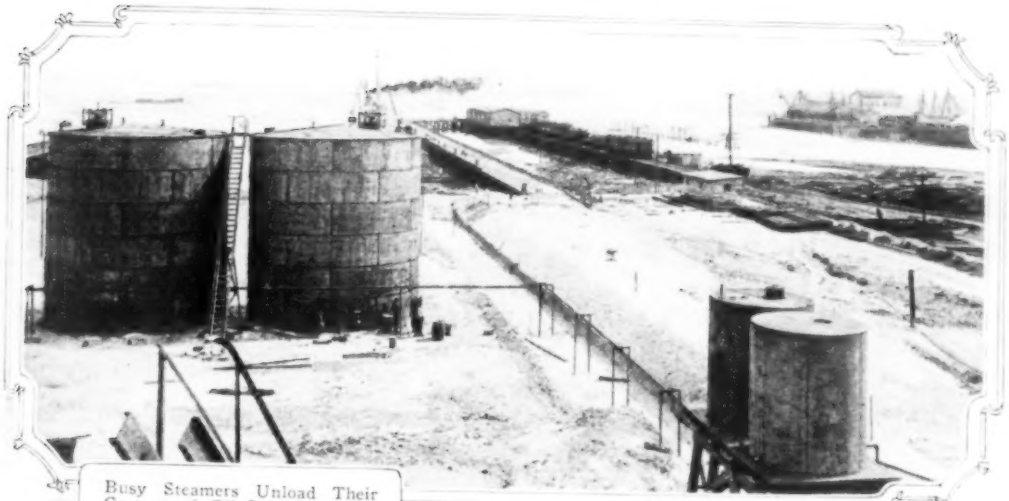
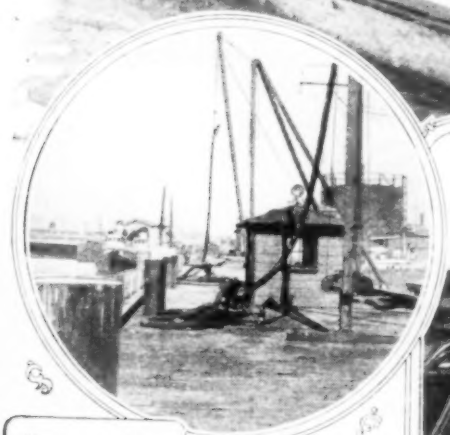


Busy Steamers Unload Their Cargoes of Oil Imported from Mexico and South America in Great Storage Tanks Erected at Gulf-Coast Ports

Towed to the Side of a Tank Ship, a Barge Brings Thousands of Gallons of Oil for Shipment across the Ocean



Hose and Derricks for Loading Oil Are Rigged Where Tankers Receive and Discharge Their Cargoes

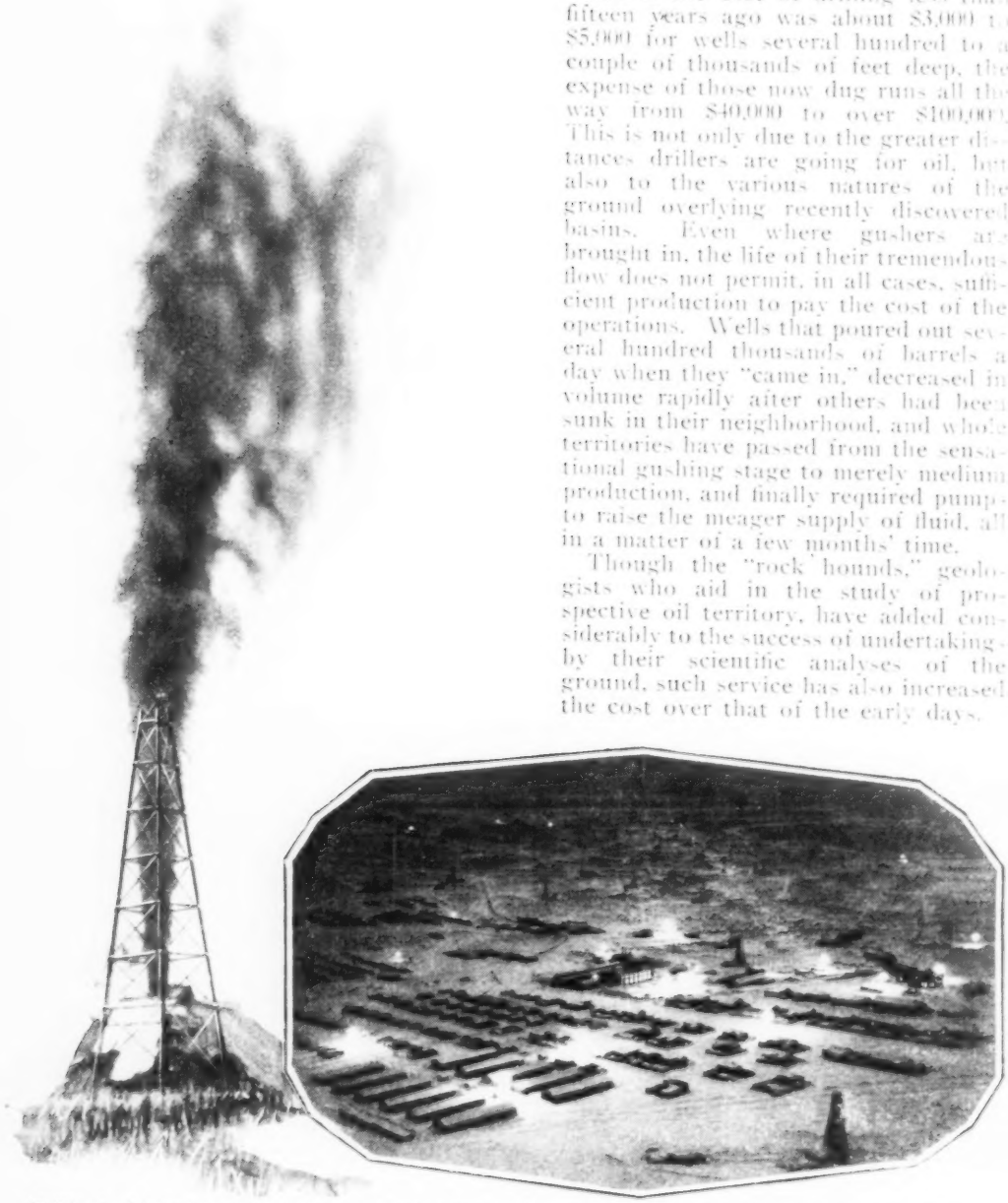
Floating Reservoirs of Oil, Leisurely Barges, Are Towed from Supply Fields to Fill Ocean-Going Tankers

Courtesy, Tulsa Oil & Gas Journal

to 10,000 feet below the surface. Once the accepted caution was to "stop at 2,000 feet," but this warning has long been discarded in the belief that the biggest oil pockets lie deepest, in some fields. But not always do the plans of oil prospectors meet with success. The old saying that more has been put into the ground than is ever taken out, in a measure still holds true. The daily average production for the approximately 285,000 oil wells operating in the United States is but seven barrels a well, an estimate considered high by some authorities. Out of 24,658 wells sunk during last year 17,318 brought in oil, 2,011 were gas wells, and the remaining 5,329 were dry holes. And many millions of dollars were involved.

While the cost of drilling less than fifteen years ago was about $3,000 to $5,000 for wells several hundred to a couple of thousands of feet deep, the expense of those now dug runs all the way from $40,000 to over $100,000. This is not only due to the greater distances drillers are going for oil, but also to the various natures of the ground overlying recently discovered basins. Even where gushers are brought in, the life of their tremendous flow does not permit, in all cases, sufficient production to pay the cost of the operations. Wells that poured out several hundred thousands of barrels a day when they "came in," decreased in volume rapidly after others had been sunk in their neighborhood, and whole territories have passed from the sensational gushing stage to merely medium production, and finally required pumps to raise the meager supply of fluid, all in a matter of a few months' time.

Though the "rock hounds," geologists who aid in the study of prospective oil territory, have added considerably to the success of undertakings by their scientific analyses of the ground, such service has also increased the cost over that of the early days.



Brilliantly Lighted for Night Work, a South American Camp, Laid Out like an Army Cantonment, Teems with the Hustle of Oil Drilling Twenty-Four Hours a Day

Selecting the Proper Vacuum Tube

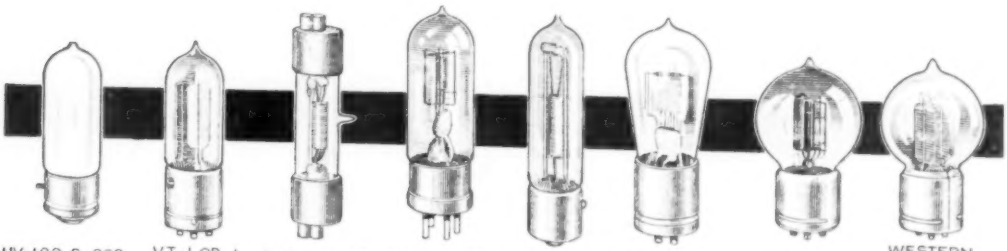
By F. L. BRITTIN

THE amateur is often at a loss to determine the proper type of vacuum tube to purchase for a definite purpose. The tube-data chart accompanying this article will prove of assistance to those who have encountered this difficulty. It gives the characteristics of the types most commonly used, and specifies how they act as detectors, amplifiers or oscillators. If a tube is not suitable for a particular purpose, the corresponding space in the table is simply marked with a dash. Thus, UV-200 tubes are indicated as being good detectors, but unsuitable for amplifiers or oscillators. The remainder of the table is self-explanatory. It might also be mentioned, however, that a negative grid voltage is only necessary when a tube is used as an amplifier. Where the B-battery voltage exceeds 60, it is well to use a C-battery, to insure a negative potential on the grids of the amplifying tubes.

All the 6-volt tubes require a storage A-battery. The 1½, 2½ and 3-volt tubes, and the N tube can be operated on dry cells. The dry-cell tubes are about 75 per cent as efficient as the 6-volt tubes, and, while they work well as detectors, are not quite so good when used as amplifiers. The UV-199, C-299 and N tubes are considered by the author as the best of the dry-cell tube family.

For use as detectors, with a storage battery, the UV-200 and C-300 tubes are recommended, and the UV-201A and C-301A as amplifiers. Where extra amplification is desired, as in large halls or auditoriums, the VT-2 or 216A tubes should be used.

A careful study of the table will well repay the amateur. Most novices buy tubes more or less at random, with the result that, while their sets may be well assembled and wired, they do not give as satisfactory results as they should.



UV-199, C-299 | VT-1 OR J TUBE | RAC-3 TUBE | WD-11 TUBE | N TUBE | UV-200 C-300 | WESTERN ELECTRIC VT-2 | WESTERN ELECTRIC 216-A

TUBES	A FILAMENT VOLTS	FILAMENT CURRENT	FILAMENT WATTS	B VOLTAGE PLATE DET.	B VOLTAGE PLATE AMP.	C NEGATIVE GRID VOLTE FOR AMP	DETECTOR	FREQUENCY AMPLIFIERS RADIO	FREQUENCY AMPLIFIERS AUDIO	POWER AMPLIFIER	OSCILLATOR	RHEOSTAT RECOMMENDED
C-299 UV-199	3.0	0.06	0.18	45	60 TO 90	1 TO 4.5	GOOD	GOOD	GOOD	FAIR	-----	40-OHM
UV-200 C-300	5.0	1.00	5.0	22½	-----	-----	GOOD	-----	-----	----	-----	(VERNIER TYPE) 6½-OHM
UV-201-A UC-301-A	5.0	0.25	1.0	45	60 TO 100	3 TO 6	GOOD	GOOD	GOOD	GOOD	GOOD	25-OHM
UC-302 UV-202	8.0	2.35	18.8	40 TO 60	100 TO 500	3 TO 9	FAIR	-----	GOOD	GOOD	GOOD	6¾-OHM
WE N TUBE	1.1	0.25	0.27	22½	45	1 TO 2	GOOD	GOOD	FAIR	-----	GOOD	6-OHM
WD-11 WD-12	1.5	0.25	0.37	22½	45 TO 60	1 TO 3	GOOD	GOOD	FAIR	----	GOOD	6-OHM
VT-1 J TUBE	2.5	0.9	0.36	22½	45 TO 90	1 TO 3	GOOD	-----	GOOD	FAIR	GOOD	(VERNIER TYPE) 6 TO 15-OHM
VT-2 E TUBE	7.0	1.35	9.45	45	45 TO 350	1 TO 40	GOOD	-----	GOOD	GOOD	GOOD	6-OHM
216-A	6.0	1.35	8.1	45	45 TO 150	1 TO 12	GOOD	-----	GOOD	GOOD	GOOD	6-OHM
RAC-3	4.0	0.8	3.2	22½	40 TO 90	1 TO 10	GOOD	GOOD	GOOD	-----	GOOD	6 OHM

Table of Characteristics of the Most Commonly Used Vacuum Tubes, Which Will Assist the Amateur in Selecting the Proper Tube for a Particular Purpose, or to Suit Storage Battery or Dry Cells

Heartbeats Broadcast

The sound of human heartbeats, broadcast from station KSD, St. Louis, Mo., was heard in Fort Bayard, N. M., 1,200 miles from St. Louis by air line. The microphone stethoscope, an invention by Dr. R. B. Abbott of Purdue university, was used to amplify the beats of the heart.

Need a Panel for the Set? Use an Old Record

There is no need for the home builder to be discouraged if his money runs out

Copyright, Underwood & Underwood
This Fair Fan Has Found a New Use for the Discarded Phonograph Record

before he has bought his panel, if there is an old phonograph record handy.

The set shown in the photo, which was exhibited at the New York show, has all the tuning dials, binding posts, etc., mounted on a record, and a very attractive looking set it makes. Some records are made of bakelite, which is as good an insulator as can be obtained, and even the ordinary record composition is a pretty good insulator.

Italian Amateur Broadcasts with Unusual Aerial

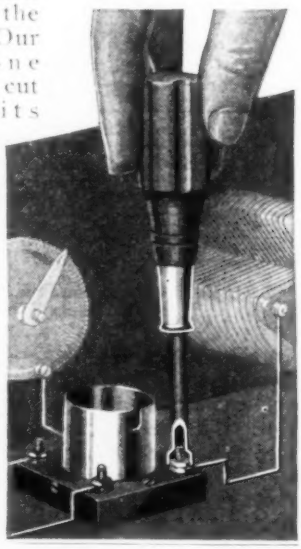
An Italian radio experimenter, Adriano Ducati, has communicated very successfully with amateurs in this country with a novel antenna arrangement, the use of which is new to radio men in the United States, according to a communication that has just been received by the American Radio Relay League. Mr. Ducati increases the capacity between his antenna and counterpoise by means of an extra counterpoise erected above the regular antenna system.

Signor Ducati is easily the foremost amateur in Italy, inasmuch as he was the first to establish two-way amateur communication with this country. Being unfamiliar with all of the methods employed by American radio men, he did not place any special stress on his novel aerial. The technical department of the A. R. R. L., however, is interested in the use of an additional counterpoise over the antenna and experiments will be made shortly to determine its special advantages.

In other respects Sr. Ducati's equipment is similar to the better class of amateur stations in this country and the results are regarded as remarkable, considering that interest in amateur radio is just awakening in Italy.

Using a Hydrometer

After using a hydrometer for testing the charge of the storage battery it often happens that a small quantity of the electrolyte remains on the hydrometer and drops off on the floor or perhaps even on one's clothes, with the result that permanent spots appear on the floor and holes are burned in the clothes; the latter usually show a few days afterward. To prevent this, the hydrometer should always be placed in a bottle, such as a milk bottle, the moment it is taken out of the electrolyte. If, in spite of all precautions, some acid is accidentally spilled on the clothes, give the spots a liberal application of ammonia.

Screwdriver-Wrench Aids Set Assembly

Made like a socket wrench, but fitted with a screwdriver handle, a new tool should prove very useful to manufacturers of radio equipment as well as to the home builder. Our photo shows one side of the tool cut away to show its construction, but the socket, of course, fits completely around the nut. The hollow stem goes down over projecting screws, enabling the hexagon to fit the nut snugly. For tightening nuts on instruments in bad locations this tool is immeasurably superior to pliers, or even straight wrenches, as it is as easy to use as a screwdriver. The tools are made in three sizes, to fit the commonest sizes of nuts used on radio fittings.